US009103101B2

(12) United States Patent
Sigelakis

(10) Patent No.: US 9,103,101 B2
(45) Date of Patent: Aug. 11, 2015

(54) **FIRE HYDRANT CONTROL VALVE**

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(72) Inventor: **George Sigelakis**, East Rockaway, NY (US)

(73) Assignee: **Sigelock Systems, L.L.C.**, East Rockaway, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/167,804**

(22) Filed: **Jan. 29, 2014**

(65) **Prior Publication Data**

US 2014/0144516 A1 May 29, 2014

Related U.S. Application Data

(62) Division of application No. 12/787,328, filed on May 25, 2010, now Pat. No. 8,640,728.

(51) **Int. Cl.**

E03B 9/02 (2006.01)
E03B 9/14 (2006.01)
E03B 9/08 (2006.01)

(52) **U.S. Cl.**

CPC ***E03B 9/14*** (2013.01); ***E03B 9/08*** (2013.01)

(58) **Field of Classification Search**

CPC E03B 9/14
USPC 137/272, 302, 304, 305, 307, 625.33
See application file for complete search history.

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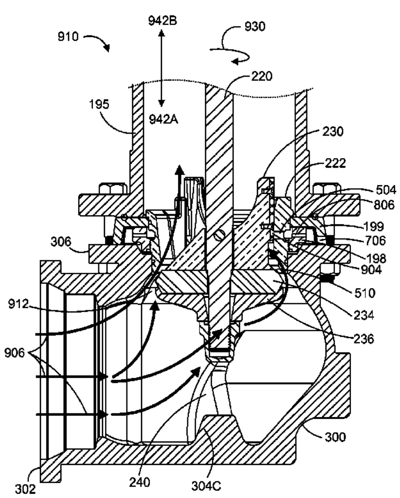
Primary Examiner — Kevin Murphy
Assistant Examiner — R. K. Arundale
(74) *Attorney, Agent, or Firm* — Martine Penilla Group, LLP

(57) **ABSTRACT**

A method of draining a standpipe includes moving a valve control device toward a closed position sufficient to uncover at least one drain hole before the valve control device achieves a fully closed position, the at least one drain hole being disposed in a slot of a saturation ring and draining a contents of the standpipe through a drain route to an external portion of the standpipe, the drain route is defined by the drain hole in the valve seat ring, drain ports in the drain ring, outlet notches and a drain channel in the saturation ring. The drain hole is radially offset from each of the drain ports in the drain ring and each of the drain ports are radially offset from each of the outlet notches in the saturation ring. A valve control device is also disclosed.

20 Claims, 20 Drawing Sheets



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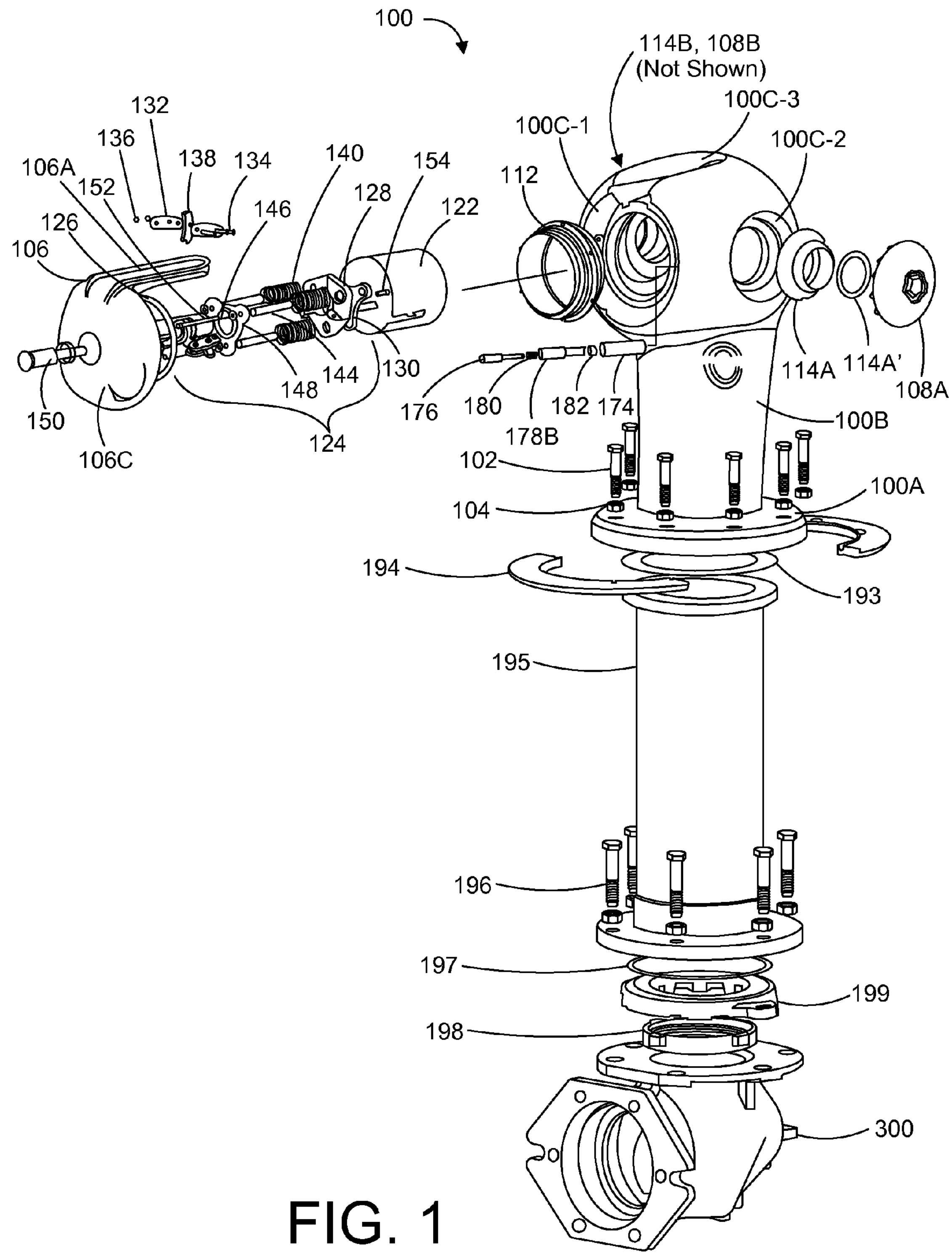
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FIG. 1

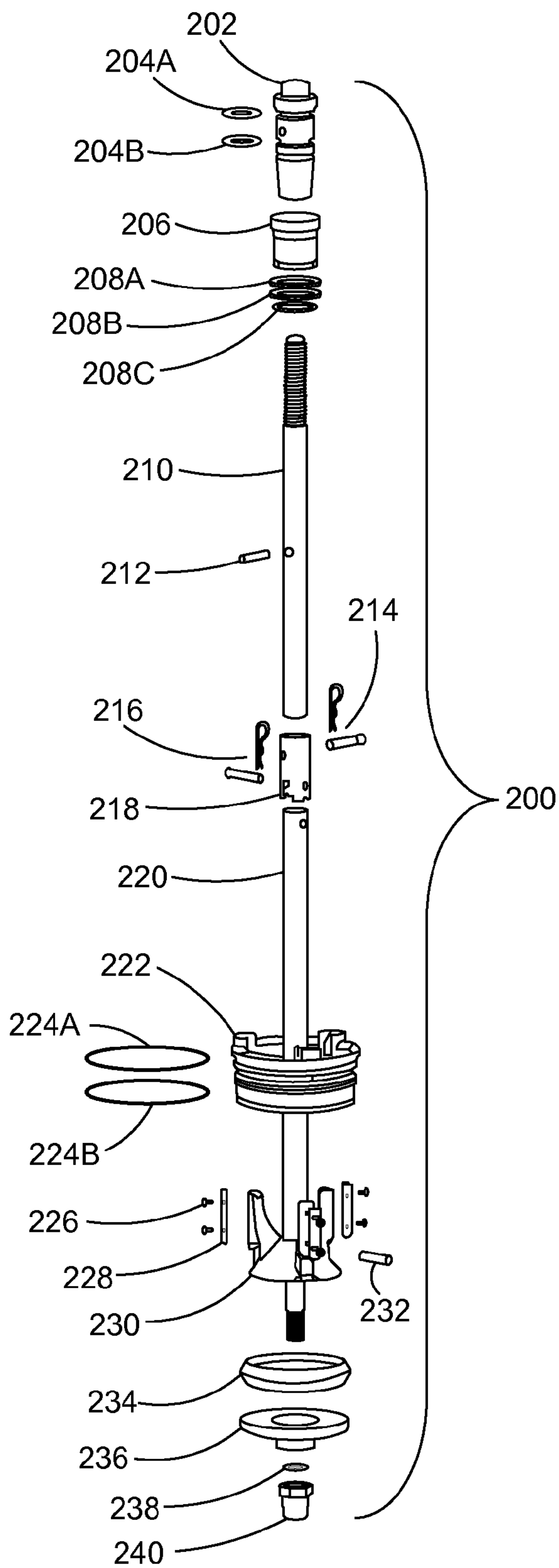
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FIG. 2

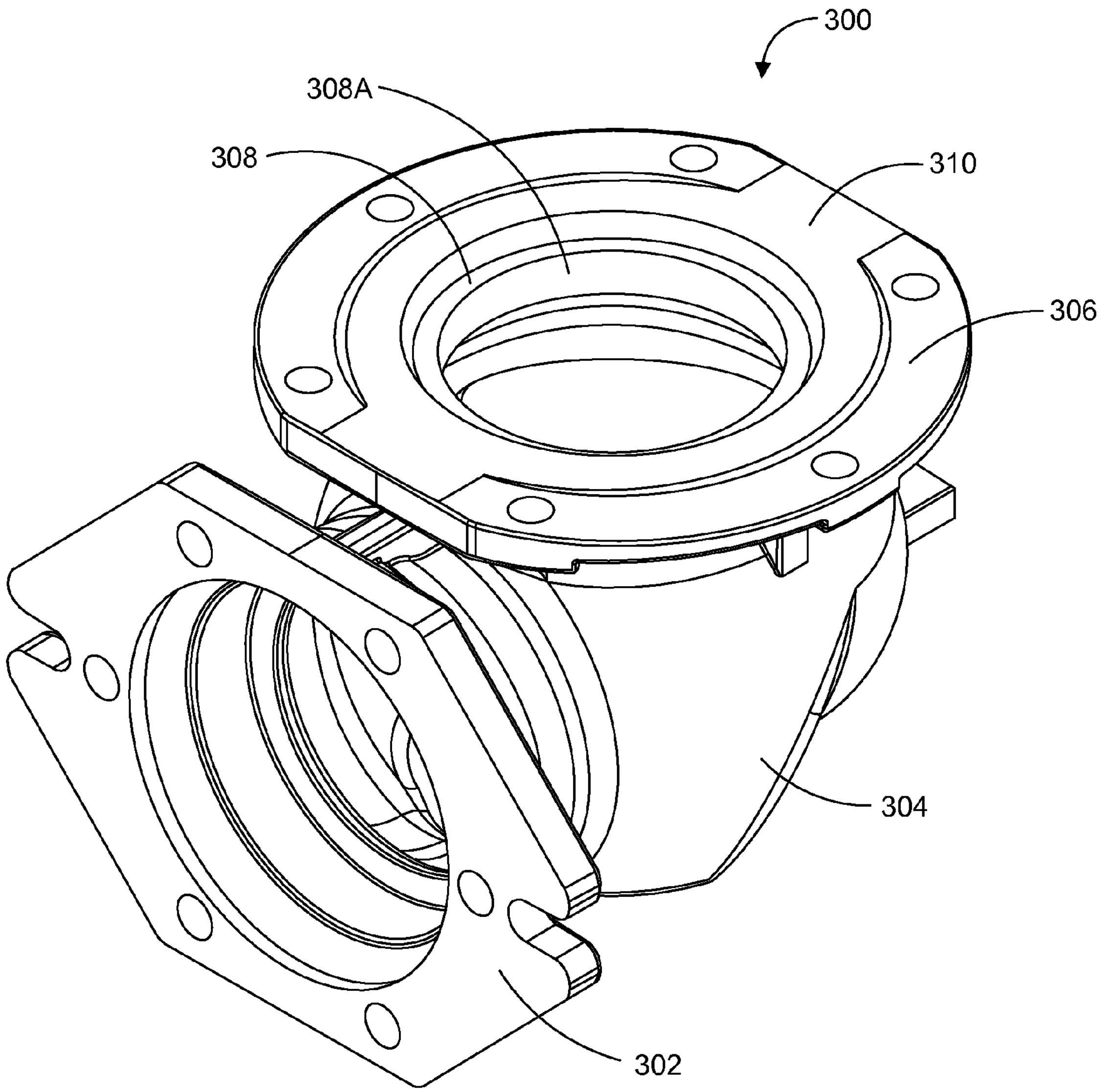

FIG. 3A

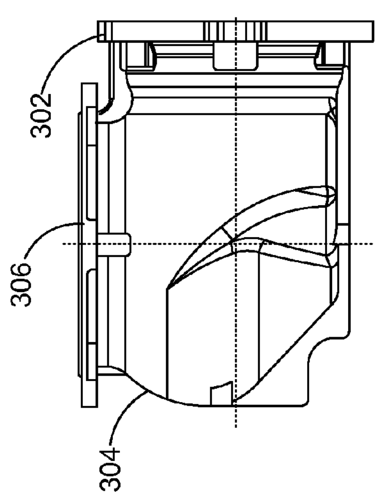

FIG. 3B

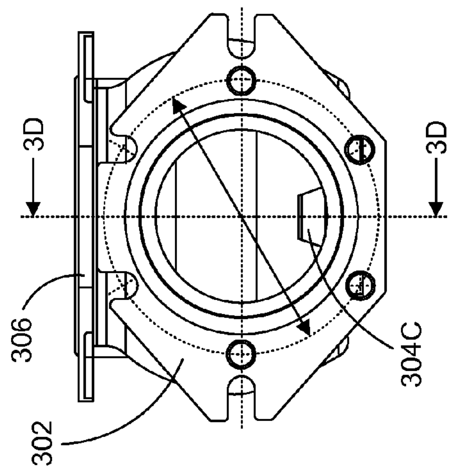

FIG. 3C

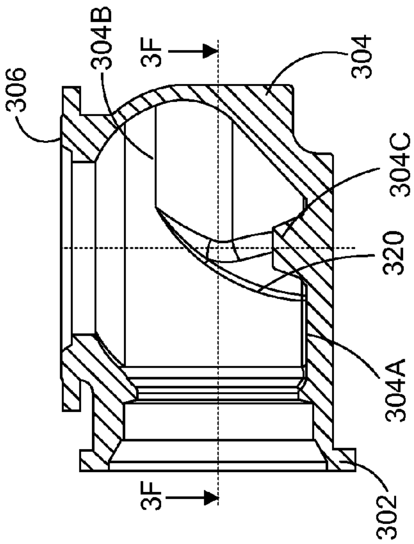

FIG. 3D

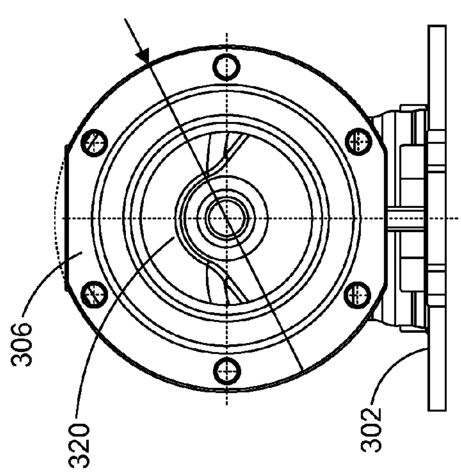

FIG. 3E

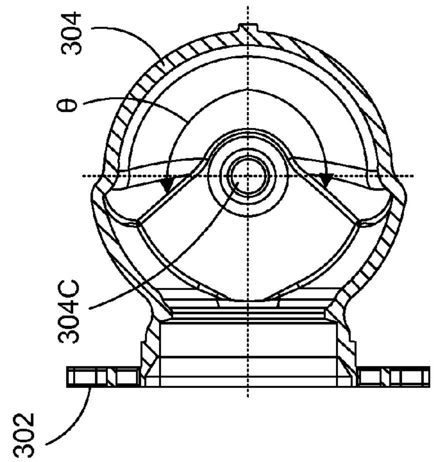

FIG. 3F

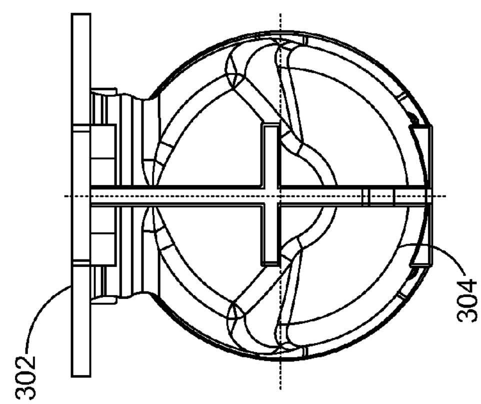

FIG. 3G

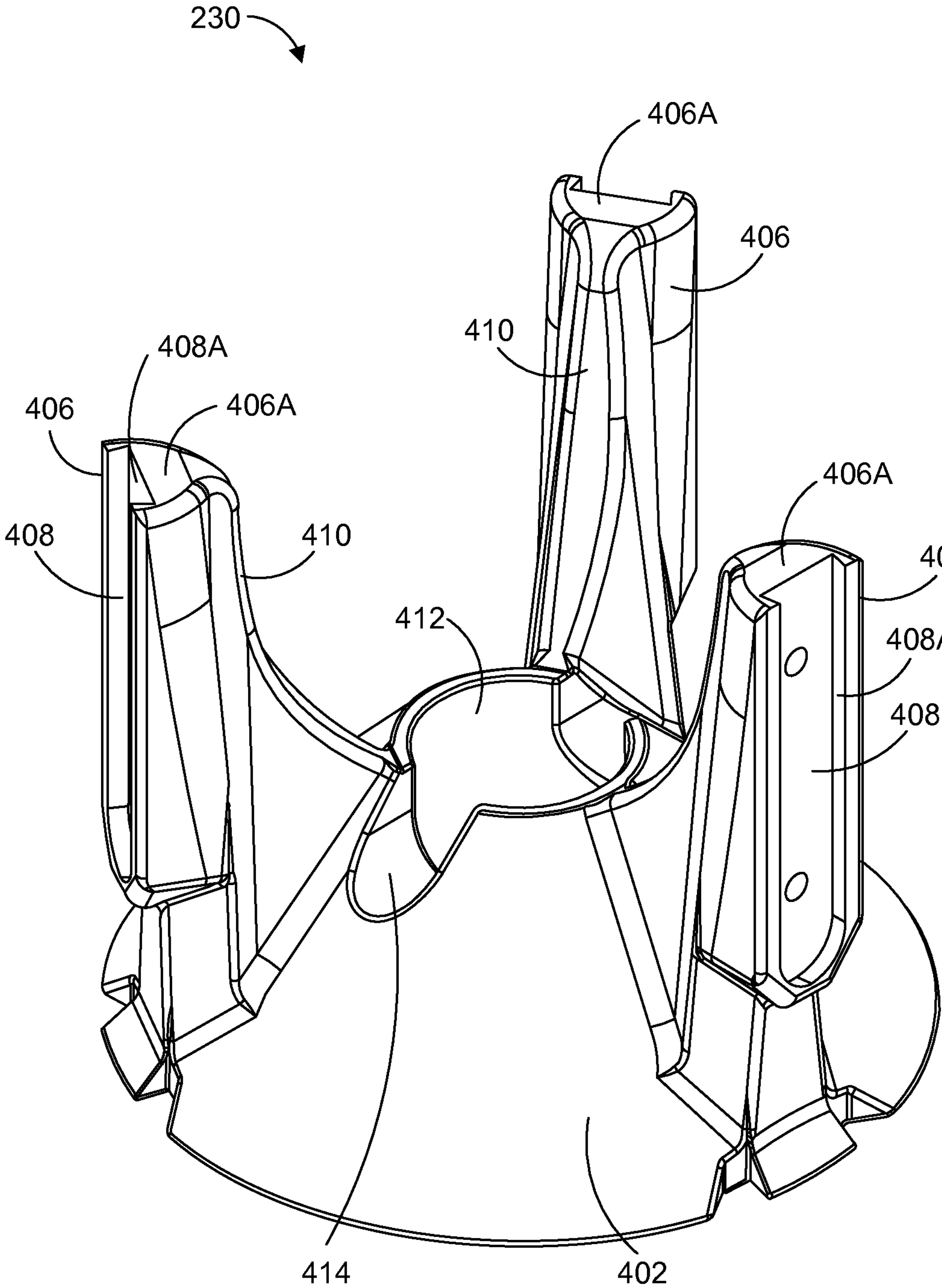
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FIG. 4A

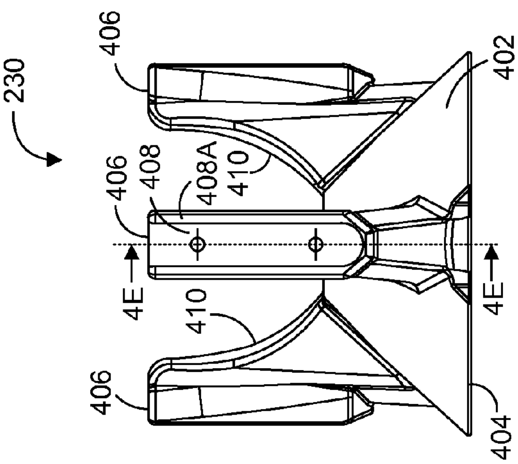


FIG. 4D

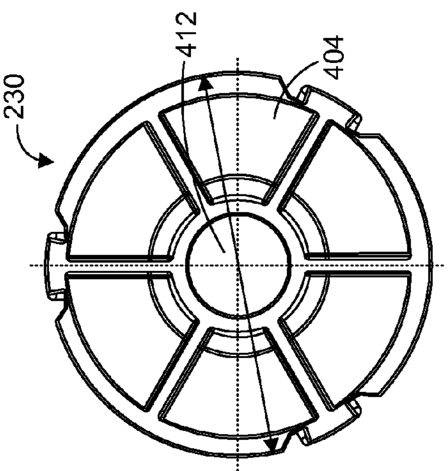
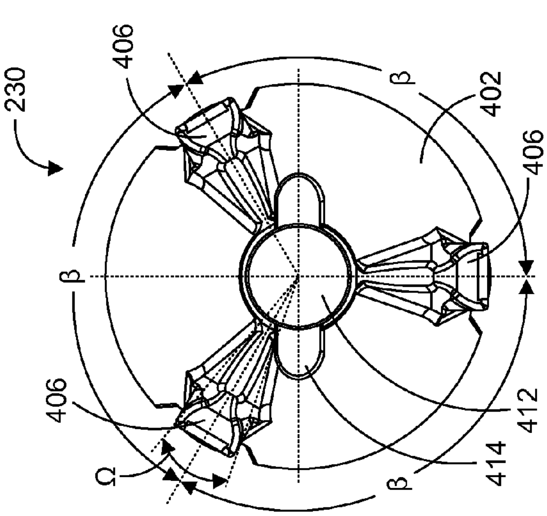


FIG. 4C



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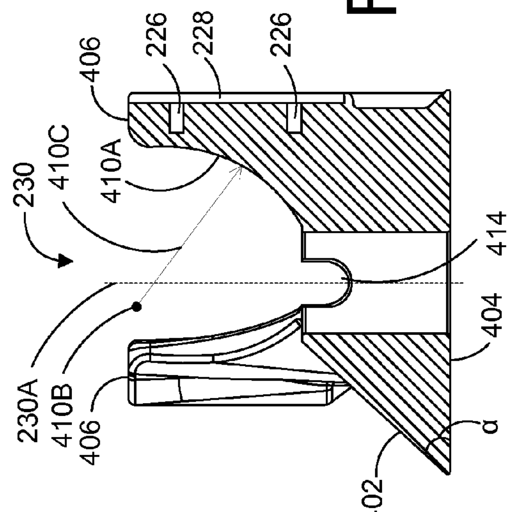

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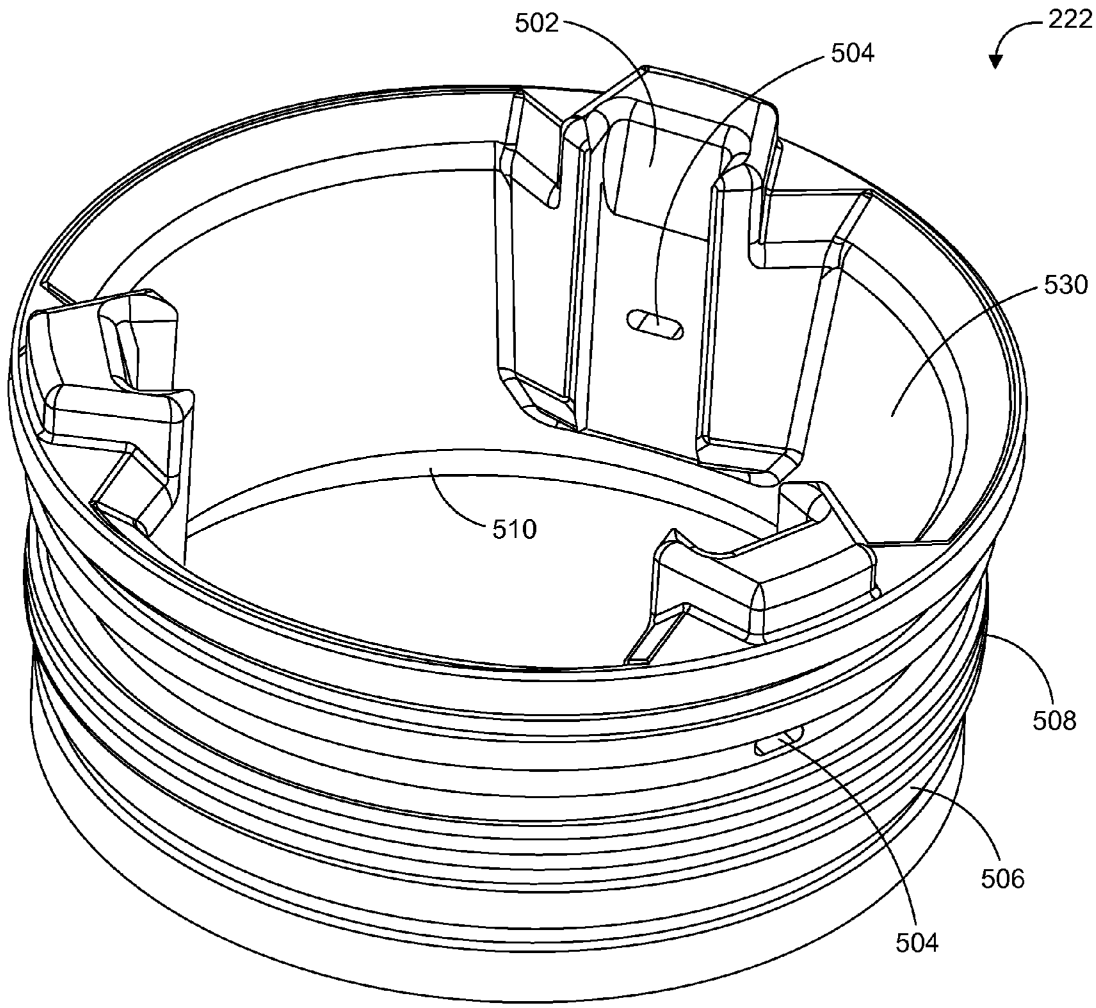

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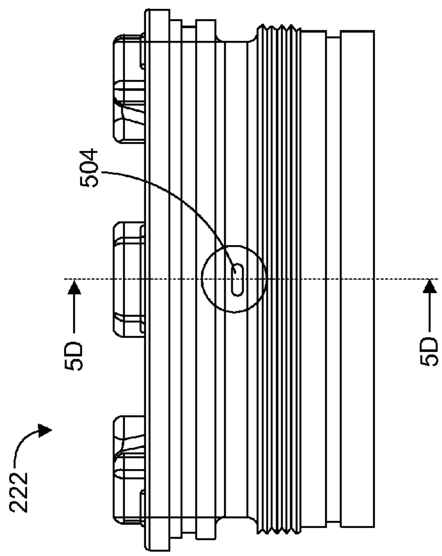

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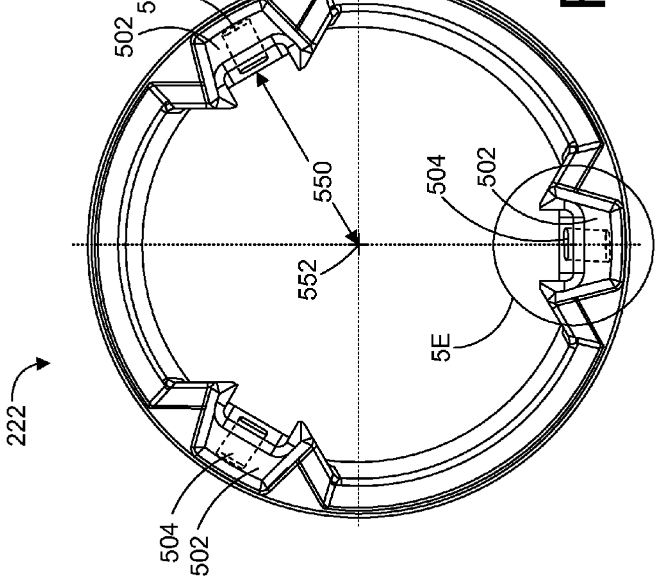

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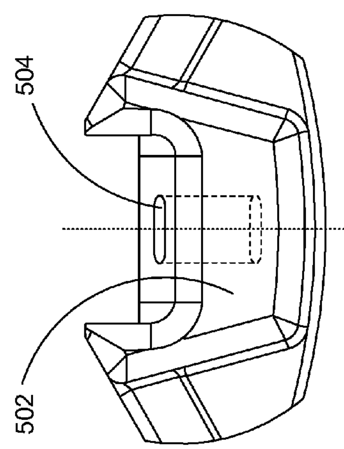

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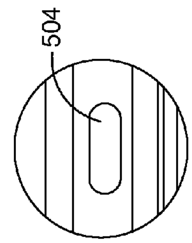

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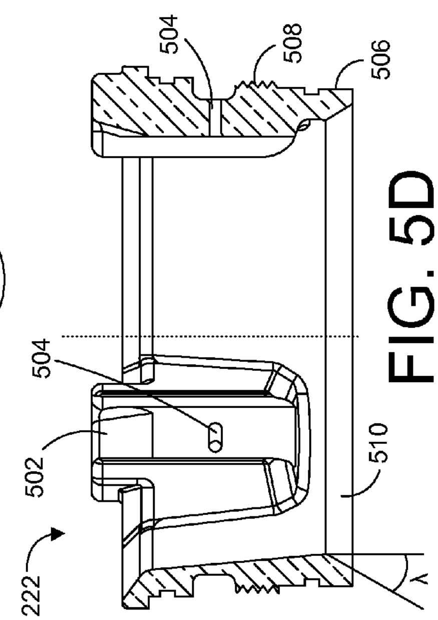

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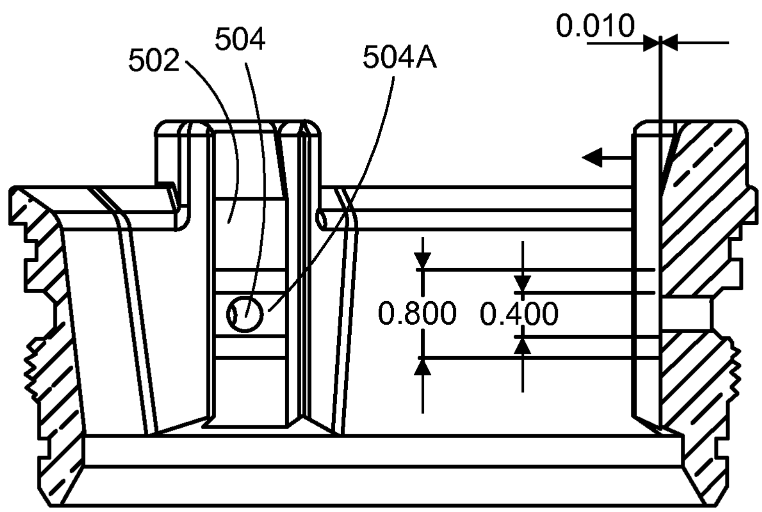

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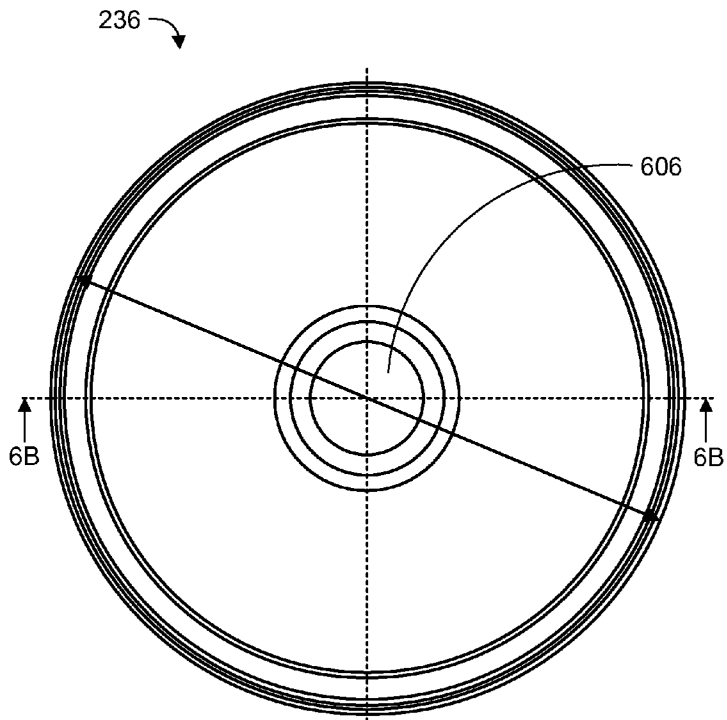


FIG. 6A

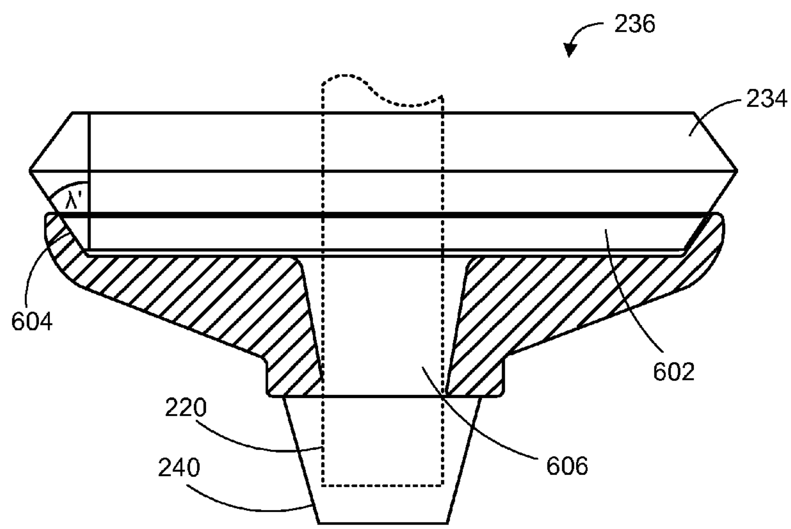


FIG. 6B

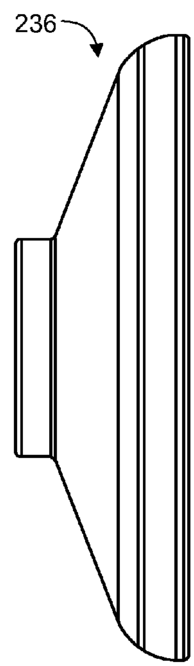


FIG. 6C

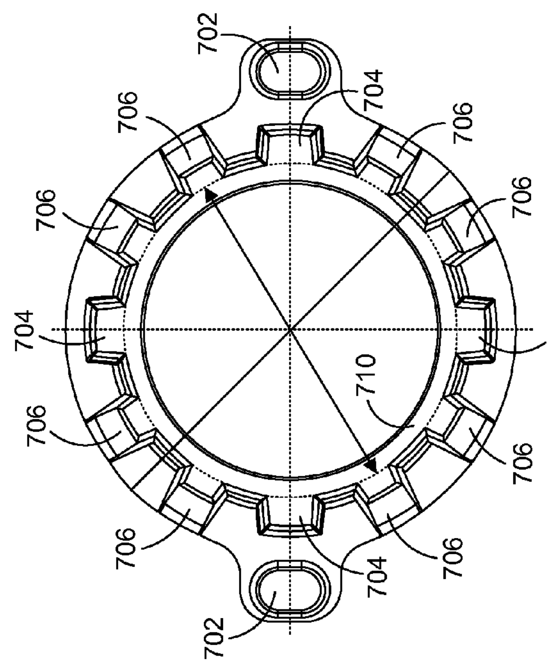


FIG. 7B

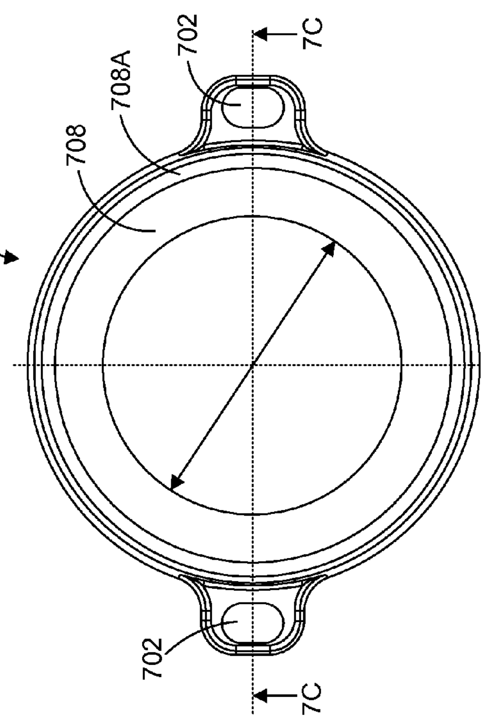


FIG. 7A

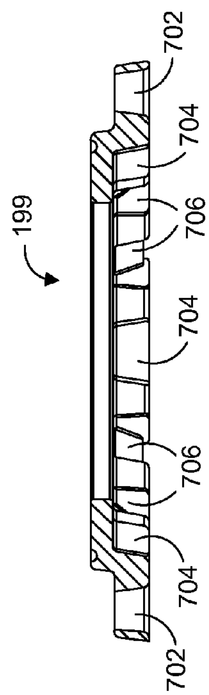


FIG. 7C

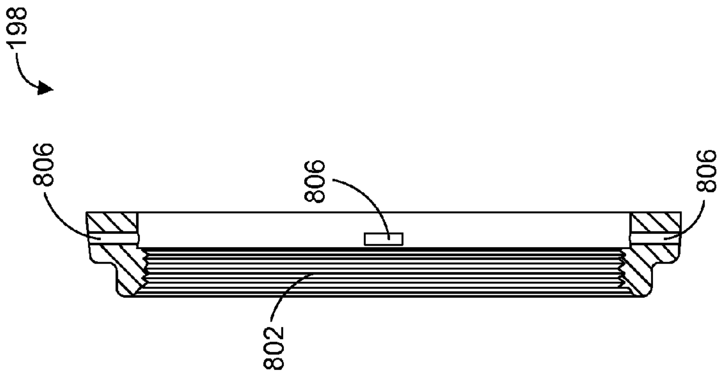


FIG. 8B

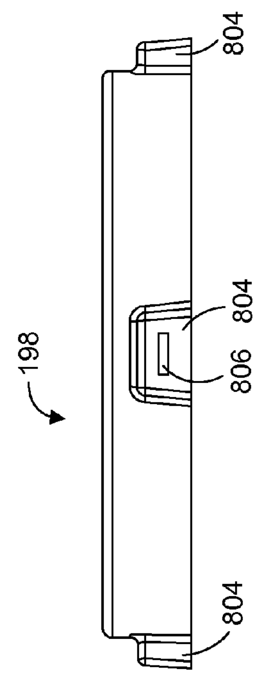


FIG. 8C

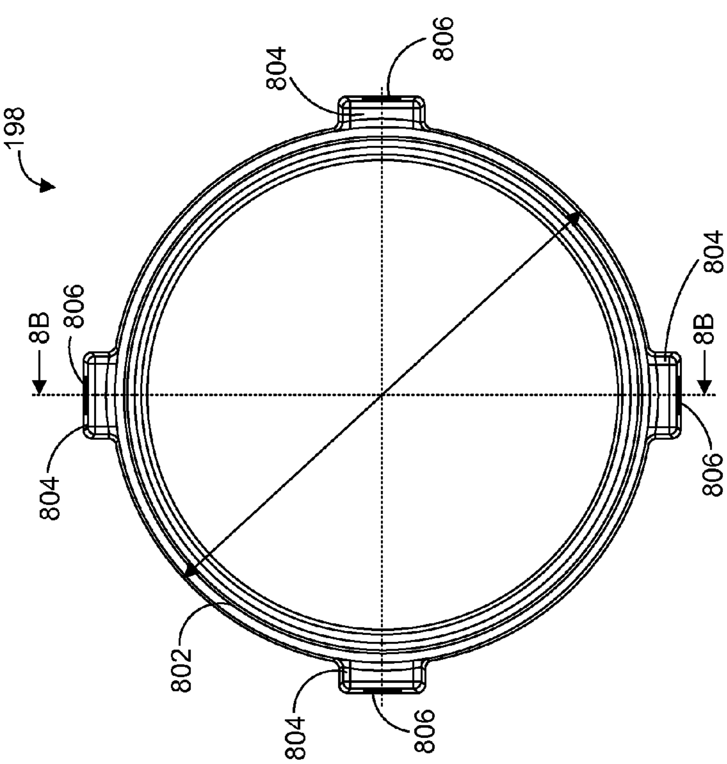
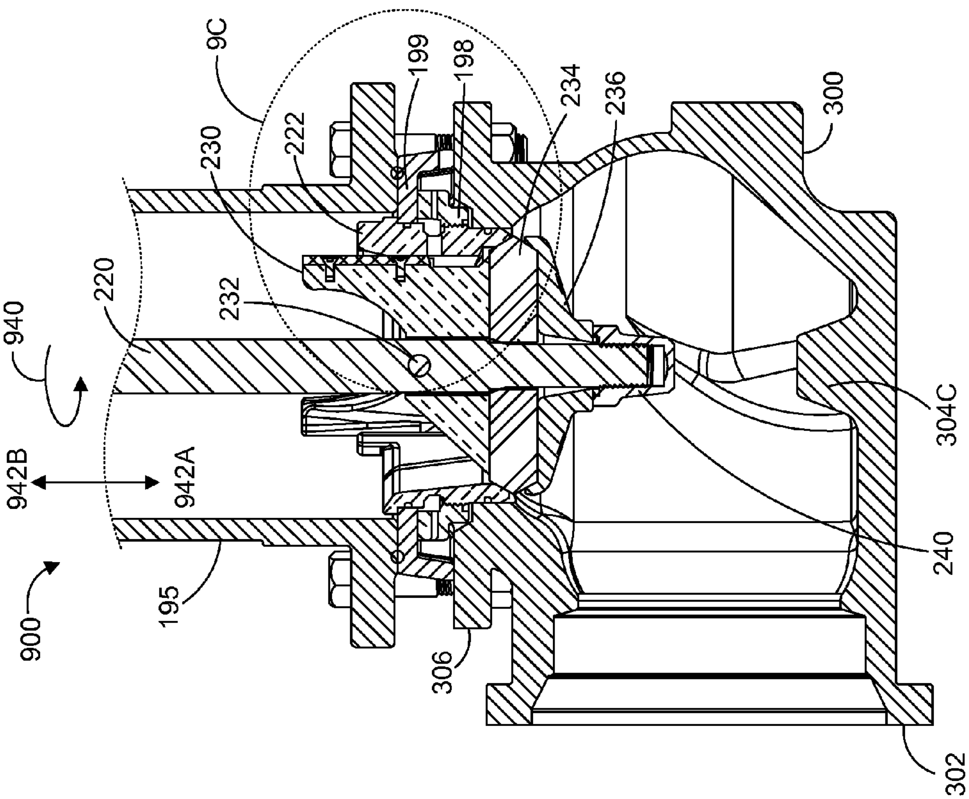


FIG. 8A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304C
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FIG. 9B

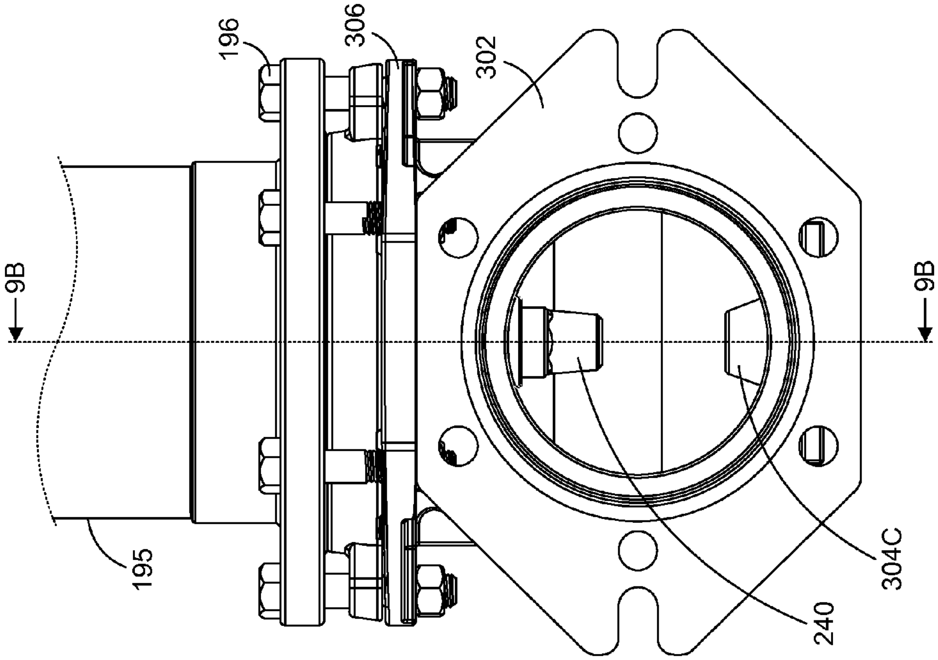
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FIG. 9A

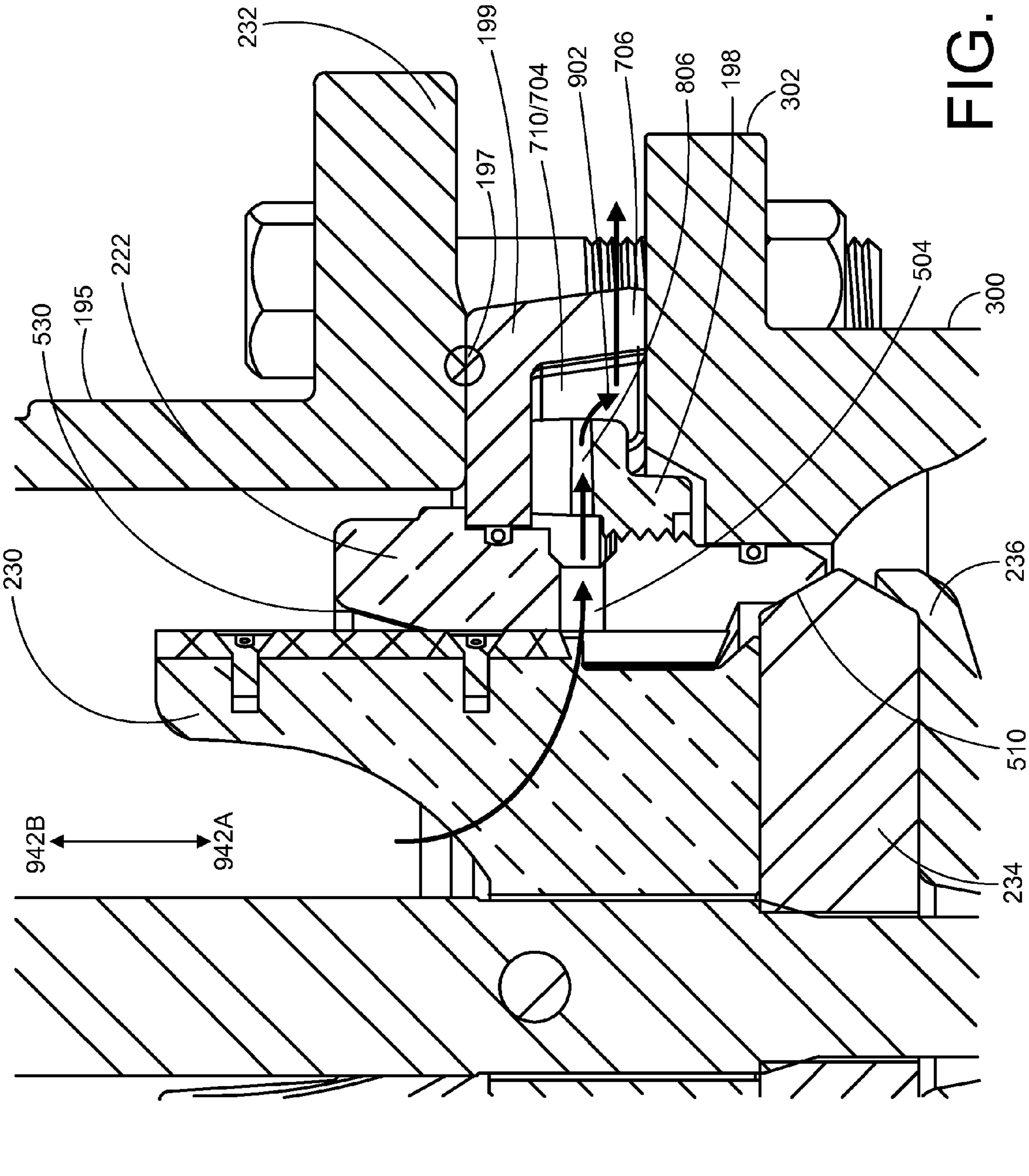
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FIG. 9C

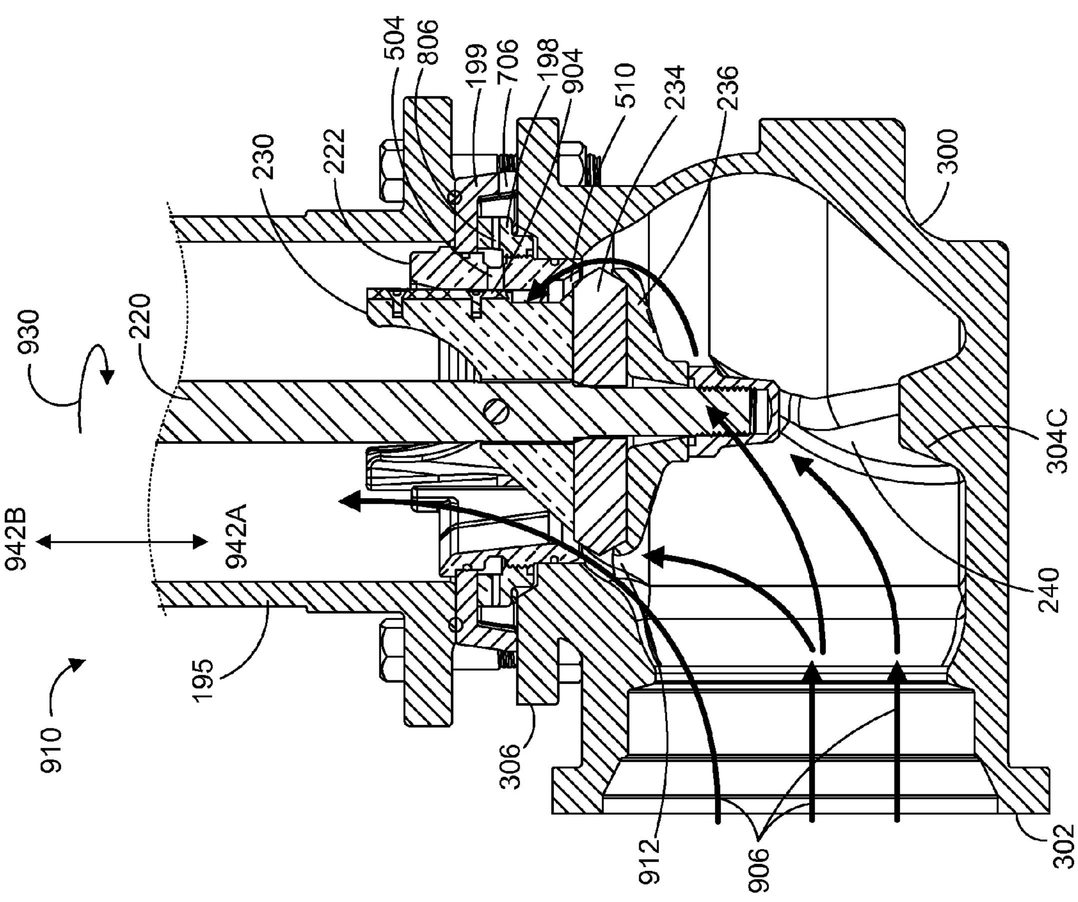
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FIG. 9D

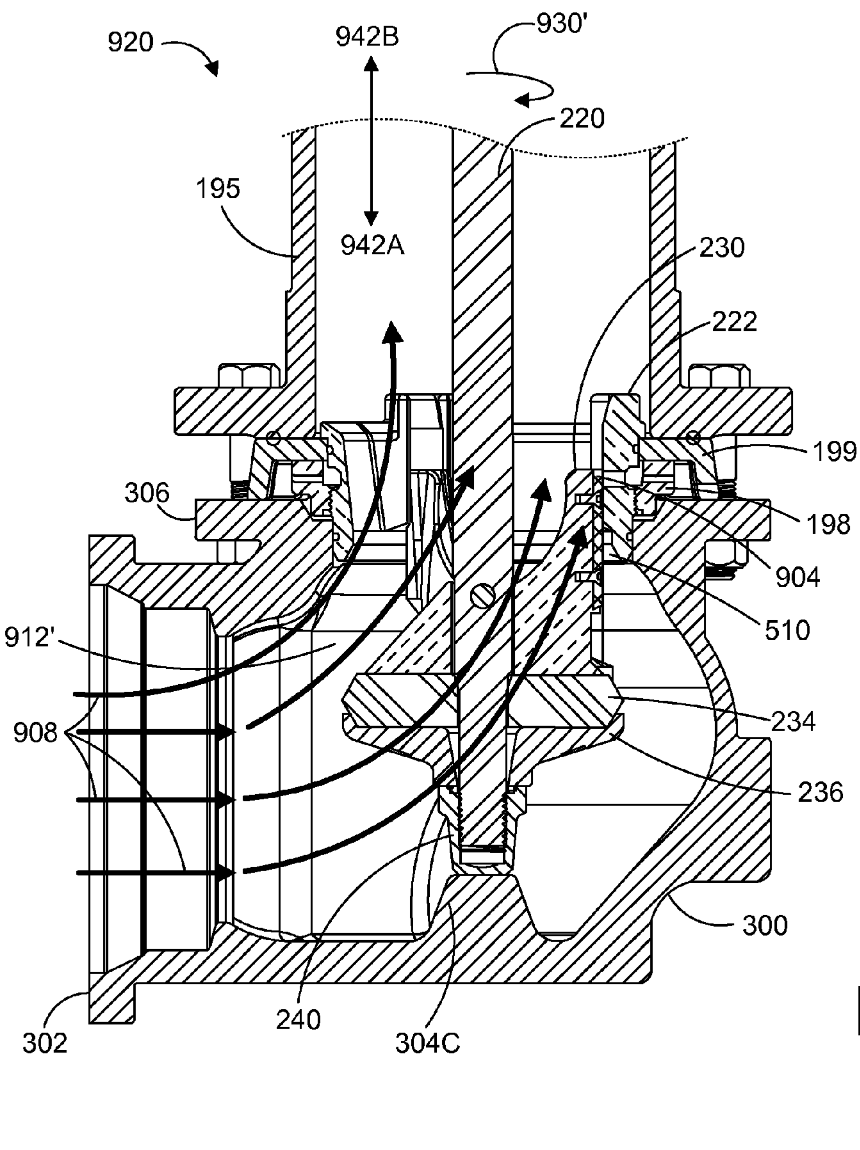
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FIG. 9E

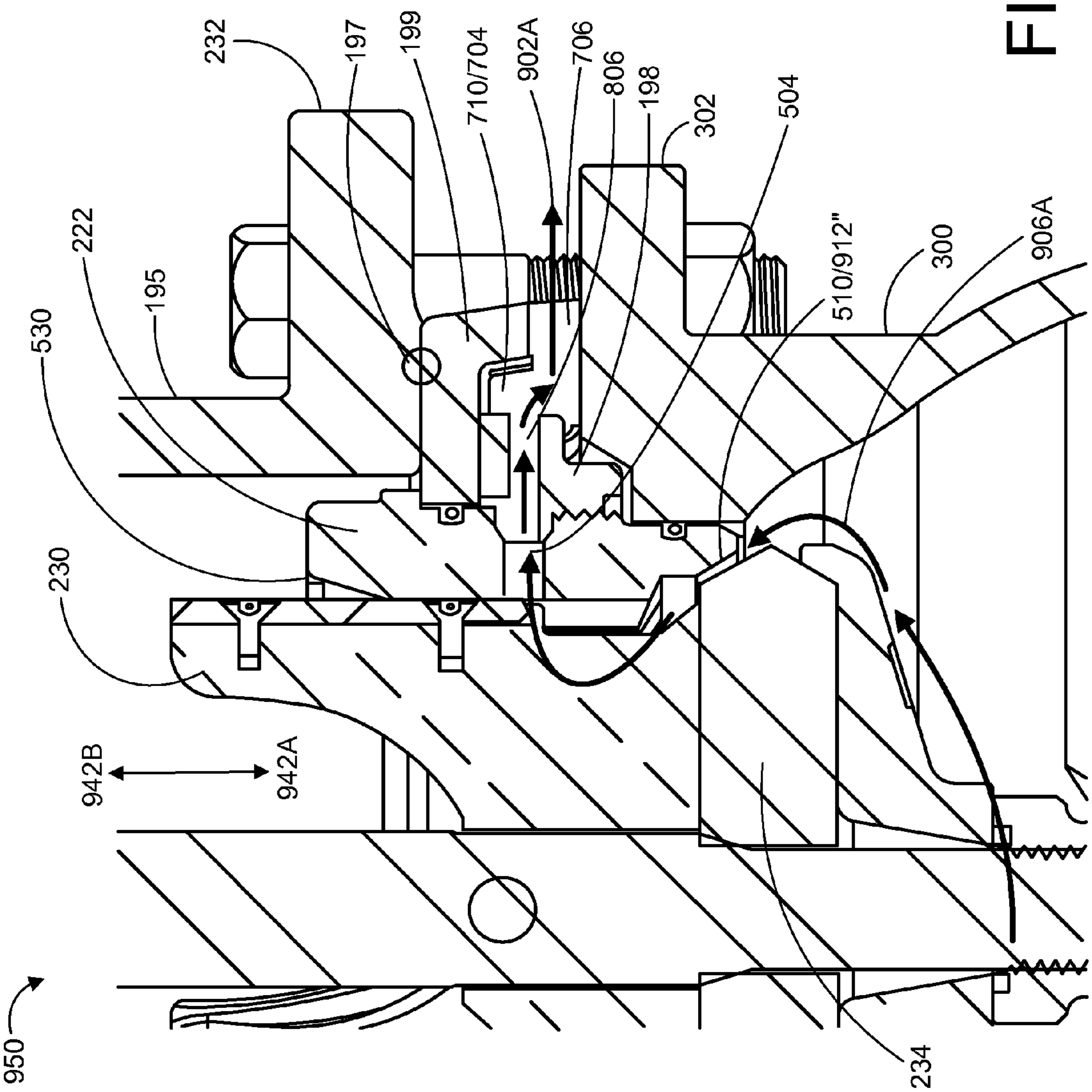
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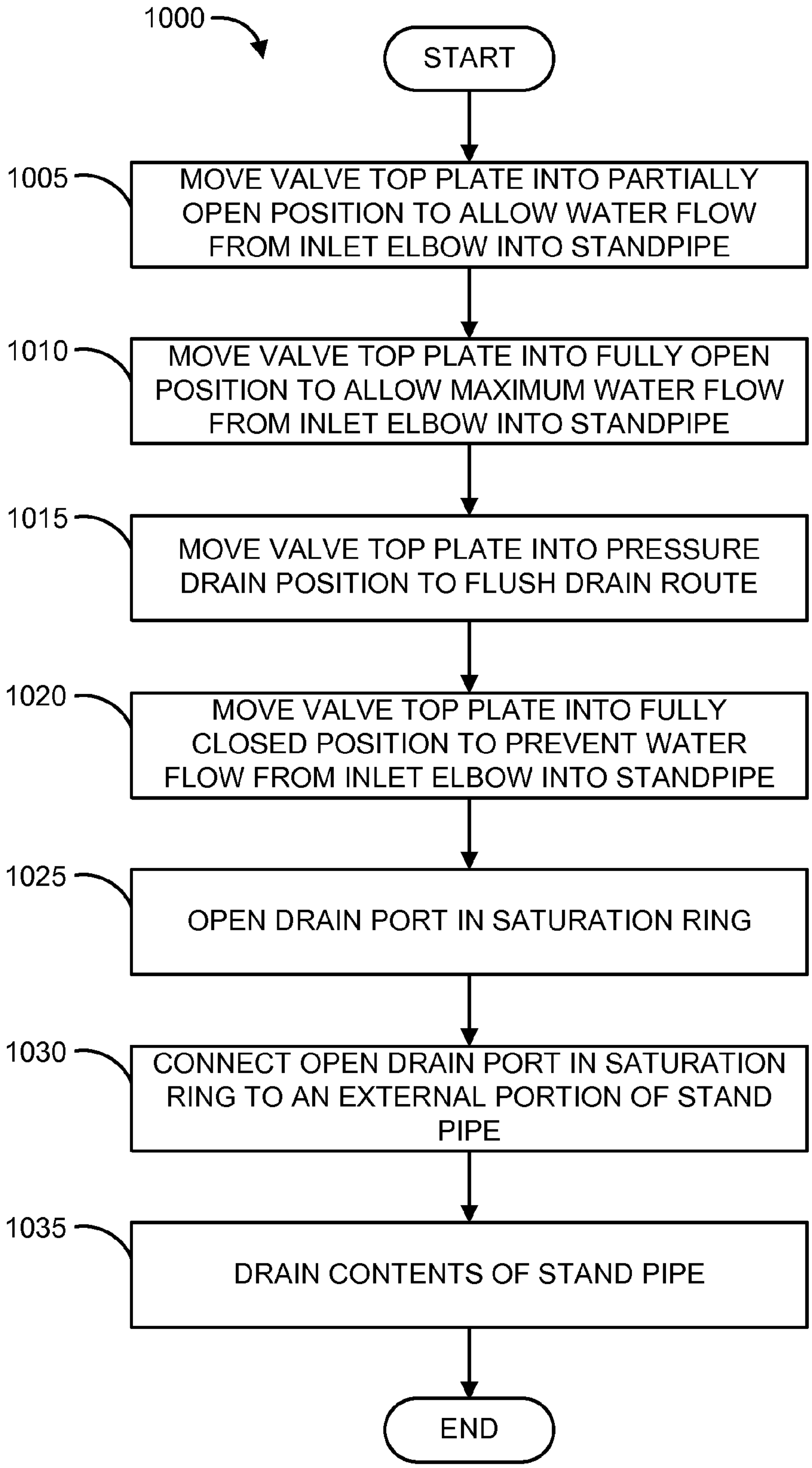
FIG. 9F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START
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MOVE VALVE TOP PLATE INTO PARTIALLY OPEN POSITION TO ALLOW WATER FLOW FROM INLET ELBOW INTO STANDPIPE
1010
MOVE VALVE TOP PLATE INTO FULLY OPEN POSITION TO ALLOW MAXIMUM WATER FLOW FROM INLET ELBOW INTO STANDPIPE
1015
MOVE VALVE TOP PLATE INTO PRESSURE DRAIN POSITION TO FLUSH DRAIN ROUTE
1020
MOVE VALVE TOP PLATE INTO FULLY CLOSED POSITION TO PREVENT WATER FLOW FROM INLET ELBOW INTO STANDPIPE
1025
OPEN DRAIN PORT IN SATURATION RING
1030
CONNECT OPEN DRAIN PORT IN SATURATION RING TO AN EXTERNAL PORTION OF STAND PIPE
1035
DRAIN CONTENTS OF STAND PIPE
END

FIG. 10

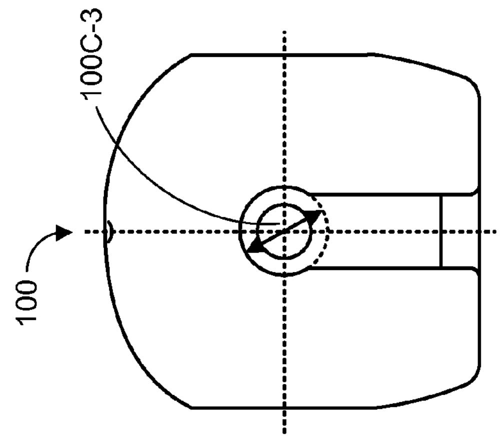

FIG. 11C

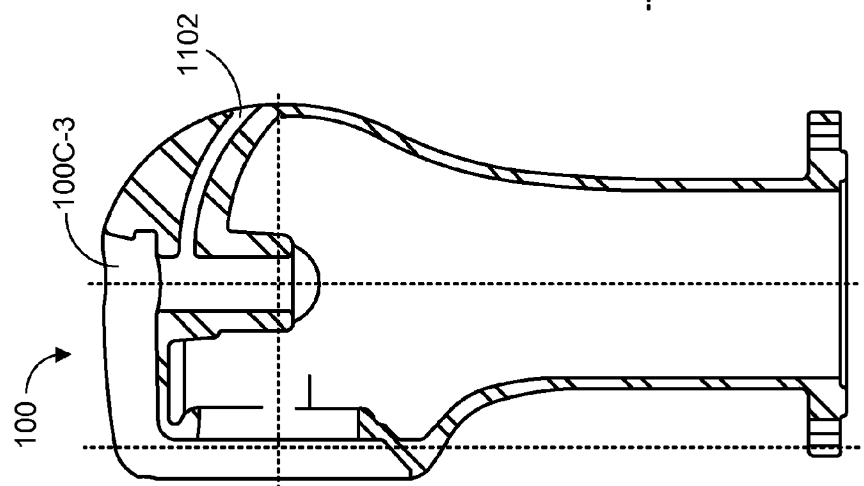

FIG. 11B

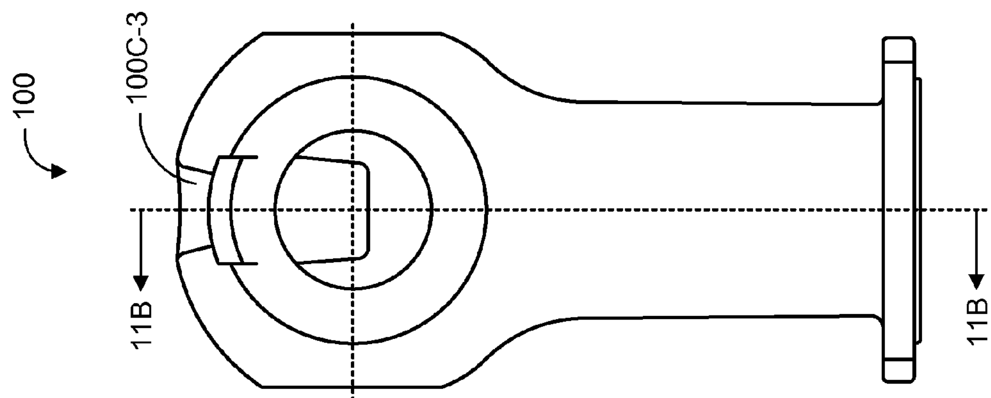

FIG. 11A

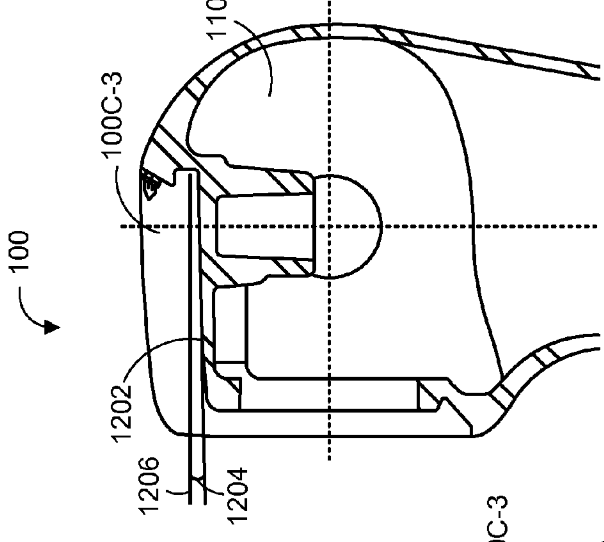

FIG. 12B

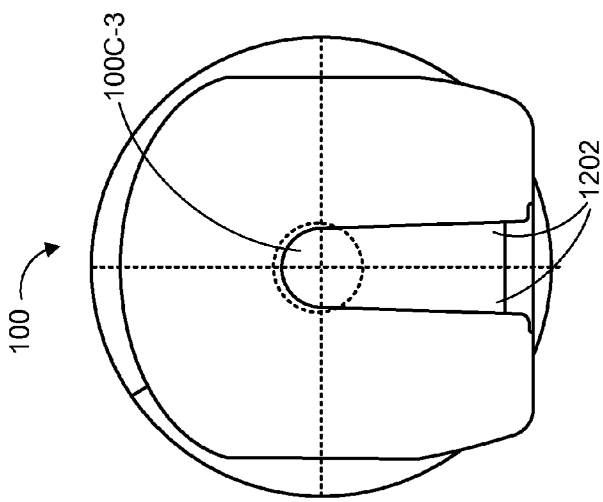

FIG. 12C

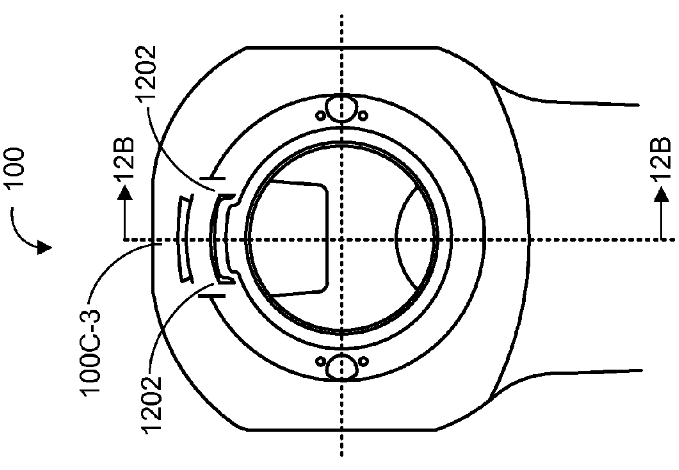

FIG. 12A

FIRE HYDRANT CONTROL VALVE

This application is a divisional of and claims priority from U.S. patent application Ser. No. 12/787,328 filed on May 25, 2010 and entitled "Fire Hydrant Control Valve," which is incorporated herein by reference in its entirety for all purposes.

BACKGROUND

The present invention relates generally to fire hydrants and, more particularly, to a control valve for a fire hydrant.

Firefighters need quick and reliable access to water to fight fires safely and effectively. Typical fire hydrants are susceptible to jamming and blockage of the control valve. Jamming and blockage of the control valve prevents firefighters from accessing water via the fire hydrant. The control valve can be jammed or blocked due to insufficient drainage of the first hydrant. The control valve can also be jammed or blocked due to intrusion of tree roots into the control valve.

In view of the foregoing, there is a need for a fire hydrant that has a control valve that is less prone to being jammed and blocked.

SUMMARY

Broadly speaking, the present invention fills this need by providing a valve control device including an operating stem, a valve top plate, a valve seat rubber, a valve bottom plate, and a valve seat ring. The valve top plate has a conical base with at least three stabilizer arms extending therefrom. Each of the at least three stabilizer arms has a flat outer surface. The valve bottom plate secures the valve seat rubber between the valve bottom plate and a flat bottom surface of the valve top plate. The valve bottom plate, the valve seat rubber, and the conical base are mounted on the operating stem. The valve seat ring has multiple slots, each of the slots corresponding to one of the at least three stabilizer arms.

In one embodiment, the valve control device also includes an inlet elbow including a bottom inner surface and a contoured floor. In one embodiment, the at least three stabilizer arms are disposed around the conical base so that centerlines of the stabilizer arms are spaced apart by 90 and 135 degrees.

In one embodiment, the operating stem includes an operating nut. The operating nut can be disposed in a fire hydrant. In one embodiment, the fire hydrant is a locking fire hydrant including a locking cap mounted on the fire hydrant, the locking cap being configured to close off a main outlet port and an access to the operating nut.

In one embodiment, the conical base forms an angle of between 20 degrees and 60 degrees between the surface of the conical base and the flat bottom surface of the valve top plate.

In one embodiment, each of the at least three stabilizer arms has a triangular cross-sectional shape having an inner angle that is opposite the flat outer surface, the inner angle being between 20 degrees and 45 degrees.

In one embodiment, each of the at least three stabilizer arms has an inner edge opposite the outer surface, the inner edge having at least one of an angle and a curve having one or more radii.

In one embodiment, the valve seat ring includes at least one drain hole, the at least one drain hole being in fluid communication with an outlet portion of the valve control device with the valve control device a closed position. The at least one drain hole is covered by one of the at least three stabilizer arms when the valve control device is in an open position.

In accordance with another aspect of the invention, a standpipe drain system is provided. The standpipe drain system includes a standpipe and a valve control device. The valve control device includes an operating stem, a valve top plate, a valve seat rubber, a valve bottom plate, and a valve seat ring. The valve top plate has a conical base having at least three stabilizer arms, each of the at least three stabilizer arms having a flat outer surface. The valve bottom plate secures the valve seat rubber between the valve bottom plate and a flat bottom surface of the valve top plate. The valve bottom plate, the valve seat rubber, and the conical base are mounted on the operating stem. The valve seat ring has multiple slots, with each of the slots corresponding to one of the at least three stabilizer arms. The valve seat ring includes at least one drain hole, the at least one drain hole being in fluid communication with an outlet portion of the valve seat ring with the valve control device in a closed position. The at least one drain hole is covered by one of the at least three stabilizer arms when the valve control device is in an open position.

In one embodiment, the standpipe drain system also includes a drain ring including multiple drain nipples, each of the drain nipples having a drain port. In one embodiment, the standpipe drain system also includes a saturation ring including a drain channel and multiple notches and multiple outlet notches. A drain route is defined by the at least one drain port in the valve seat ring, the drain ports in the drain ring, and the notches and the outlet notches and the drain channel in the saturation ring. The drain route provides a fluid communication route between an outlet portion of the valve seat ring in the standpipe and an external portion of the standpipe.

In accordance with another aspect of the invention, a method of draining a standpipe is provided. This method includes closing a valve control device including uncovering a drain hole in a slot of a saturation ring, the drain hole being in an outlet portion of the saturation ring. The method also includes draining the contents of the standpipe through a drain route to an external portion of the standpipe. The drain route includes the at least one drain port in the valve seat ring, multiple drain ports in a drain ring, and multiple notches and multiple outlet notches and a drain channel in a saturation ring.

In one embodiment, the method of draining a standpipe can also include opening the valve control device including covering the drain hole in the slot of the saturation ring. In one embodiment, the drain hole in the slot of the saturation ring is covered by an outer surface of a stabilizer arm of a valve top plate. In one embodiment, the drain hole in the slot of the saturation ring is uncovered by moving an outer surface of a stabilizer arm of a valve top plate in the slot in the valve seat ring until the drain hole is uncovered.

In one embodiment, the standpipe is coupled to a fire hydrant. In one embodiment, the fire hydrant is a locking fire hydrant including a locking cap mounted on the fire hydrant, the locking cap being configured to close off a main outlet port and an access to the operating nut.

In accordance with another aspect of the invention, a locking fire hydrant with a valve access channel drain is provided. The locking fire hydrant includes a locking cap mounted on the fire hydrant, the locking cap being configured to close off a main outlet port, a valve access channel, and at least one drain channel in the valve access channel.

It is to be understood that the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute part of this specification, illustrate exemplary embodiments and together with the description serve to explain the principles of the invention, as claimed.

FIG. **1** is an exploded view of the components of a locking fire hydrant, standpipe and inlet elbow, in accordance with one embodiment of the invention.

FIG. **2** is an exploded view of the components of a valve control device **200**, in accordance with one embodiment of the invention.

FIGS. **3**A-**3**G show different views of the inlet elbow, in accordance with one embodiment of the invention.

FIGS. **4**A-**4**E show different views of the tri-arm valve top plate, in accordance with one embodiment of the invention.

FIGS. **5**A-**5**G show different views of the valve seat ring, in accordance with one embodiment of the invention.

FIGS. **6**A-**6**C show different views of the valve bottom plate, in accordance with one embodiment of the invention.

FIGS. **7**A-**7**C show different views of the saturation ring, in accordance with one embodiment of the invention.

FIGS. **8**A-**8**C show different views of the drain ring, in accordance with one embodiment of the invention.

FIGS. **9**A-**9**F show different views of the inlet elbow and the valve control device **200**, in accordance with one embodiment of the invention.

FIG. **10** is a flow chart diagram illustrating the method operations performed in operating the valve control device, in accordance with one embodiment of the invention.

FIGS. **11**A-**11**C show different views of the fire hydrant body, in accordance with one embodiment of the invention.

FIGS. **12**A-**12**C show different views of the fire hydrant body, in accordance with one embodiment of the invention.

DETAILED DESCRIPTION

Several exemplary embodiments will now be described in detail with reference to the accompanying drawings.

Locking Fire Hydrant

FIG. **1** is an exploded view of the components of a locking fire hydrant, standpipe and inlet elbow, in accordance with one embodiment of the invention. As shown in FIG. **1**, the locking fire hydrant includes a fire hydrant body **100**, which is fastened to a standpipe **195** by bolts **102** and nuts **104**. Locking cap **106** is mounted on fire hydrant body **100** to close off a main outlet port **112** defined in the fire hydrant body. Side caps **108**A and **108**B are mounted on fire hydrant body **100** to close off respective auxiliary side outlet ports **114**A and **114**B defined in the fire hydrant body. As used herein, the terms "side cap" and "auxiliary cap" are used interchangeably to refer to the cap used to close off an auxiliary outlet port defined in the fire hydrant body, i.e., any outlet port other than the main outlet port. Plunger assemblies **110**A and **110**B are provided in internal channels formed in fire hydrant body **100** on opposite sides of the main outlet port **112** defined in the fire hydrant body. When locking cap **106** is mounted on fire hydrant body **100**, plunger assemblies **110**A and **110**B are actuated so that plungers extend into the recessed areas that surround the side outlet ports **114**A and **114**B defined in fire hydrant body **100**. The plungers **110**A and **110**B interface with ratchet teeth formed on the back side of side caps **108**A and **108**B.

Also as shown in FIG. **1**, fire hydrant body **100** includes flange **100**A, neck **100**B, and head **100**C. Flange **100**A has a plurality of holes formed therethrough and these holes are used to fasten the flange to a safety flange **194** using bolts **102** and nuts **104**. The safety flange **194** captures seal **193** between the standpipe **195** and the flange **100**A. As shown in FIG. **1**,

flange **100**A is a generally circular flange that extends from the lower portion of neck **100**B; however, it will be apparent to those skilled in the art that the configuration of the flange may be varied to meet the needs of particular situations. Fire hydrant body **100**, as well as the other components of the locking fire hydrant described below, may be made of any suitable material, e.g., stainless steel, iron, ductile iron, brass, bronze, stainless steel, plastics, and composite materials and combinations thereof.

The standpipe **195** is coupled to the inlet elbow **300** using bolts **196**. A saturation ring **199**, a drain ring **198** and an inlet flange seal **197** are captured between the inlet flange on the standpipe **195** and the inlet elbow **300**. The saturation ring **199** and the drain ring **198** are described in more detail below with reference to in FIGS. **7**A-**7**C and **8**A-**8**C.

Head **100**C defines a hollow interior and has a generally rounded outer configuration that includes a number of recessed portions that are configured to protect components mounted thereon. In particular, head **100**C includes main cap recess **100**C-**1**, side cap recess **100**C-**2**, and valve access channel **100**C-**3**. Main cap recess **100**C-**1** surrounds cylinder **112**, which has an inner surface and an outer surface. The inner surface of cylinder **112** defines a main outlet port of head **100**C and the outer surface is threaded so that a complementarily threaded coupling member of a fire hose can be fastened thereon, as is well known to those skilled in the art.

Side cap recesses **100**C-**2** surround cylinders **114**A and **114**B, each of which has an inner surface and an outer surface. The respective inner surfaces define auxiliary side outlet ports of head **100**C and the respective outer surfaces are threaded so that either a complementarily threaded coupling member of a fire hose or a threaded side cap (e.g., side cap **108**A) can be fastened thereon.

Valve access channel **100**C-**3** is formed in the upper portion of head **100**C and is configured to receive tongue **106**A that extends from cap body **106**C of locking cap **106**. The tongue **106**A prevents access to valve control device **200** (described in more detail below with reference to FIG. **2**) disposed within fire hydrant body **100** when the locking cap **106** is secured to the head **100**C. Additional details of the fire hydrant body **100** are explained in more detail in co-owned, co-pending U.S. application Ser. No. 12/482,366, filed on Jun. 10, 2009 and entitled "Locking Fire Hydrant" the disclosure of which is incorporated herein by reference in its entirety for all purposes. Additional details regarding a fire hydrant body that is configured to protect a locking cap from being tampered with by unauthorized users are set forth in U.S. Pat. No. 6,688,326 B1, the disclosure of which is incorporated herein by reference in its entirety for all purposes.

The locking mechanism **124** is surrounded by an optional lock cover **122**, which has a generally cylindrical configuration. Lock cover **122** is provided to minimize the degree to which the locking mechanism is exposed to potentially harmful elements, e.g., dirt, foreign objects, etc. Lock cover **122** can be made from any suitable material. By way of example, lock cover **122** can be made of stainless steel or plastic. Gasket **126** is provided on the inner surface of locking cap **106** to provide a seal around the main outlet port when the locking cap is mounted on fire hydrant body **100**.

The locking mechanism **124** includes top plate **128**, which has a central hole and three peripheral holes formed therethrough. The outer surface of top plate **128** is configured to receive spring support **130**, and the inner surface of the top plate is provided with three mounting anchors. Three pairs of support arms **132** connect top plate **128** to the inner surface of locking cap **106**. Each support arm **132** has three holes formed therethrough. One end of each support arm **132** is fastened to one of the mounting anchors on the inner surface of top plate, and the opposite end of each support arm is fastened to one of mounting anchors **106**C provided on the inner surface of locking cap **106**. Support arms **132** are fastened using bolts **134** and hex nuts **136**; however, it will be apparent to those skilled in the art that other suitable fasteners can be used. A cam gear **138** is rotatably fastened between each pair of support arms **132**. Each cam gear **138** has a cam surface at one end thereof and a set of gear teeth at the opposite end thereof.

Three springs **140** are disposed between top plate **128** and cap plate **142**, which has a central hole formed therethrough. In one embodiment, springs **140** are heavy duty die springs (at least about 2,500 pounds total spring pressure); however, it will be apparent to those skilled in the art that any suitable springs can be used. Each spring **140** is disposed on a spring shaft **144**, which has a hollow interior that receives a screw **146**. Each screw **146** is threaded into spring support **130**. Washers **148** are disposed between the head of each screw **146** and the outer surface of cap plate **142**.

Actuator pin **150** extends through a central aperture defined in locking cap **106**. Rack **152** has a generally cylindrical configuration and a hollow interior and receives extension portion of actuator pin **150**. The outer surface of rack **152** is provided with a number of cylindrical gears, which are configured to mate with the gear teeth provided at one end of each of cam gears **138**.

To enable locking mechanism **124** to operate when lock cover **122** is in place, slots are provided in the locking cover. Each slot is located so that the cam surface of a cam gear **138** can extend therethrough and interface with a mating surface inside the fire hydrant body to lock and unlock locking mechanism **124**.

Valve Control Device

FIG. **2** is an exploded view of the components of a valve control device **200**, in accordance with one embodiment of the invention. The valve control device **200** includes an operating nut **202**, seals **204**A, **204**B, operating nut sleeve **206**, thrust washers **208**A, **208**B, and retaining ring **208**C. The seals **204**A, **204**B provide a substantially water tight seal between the operating nut **202** and the valve access channel **100**C-**3** in the head **100**C (see FIG. **1**). The operating nut **202** is attached to an upper operating stem **210**. One or more stem grooved pins **212** are included in the upper operating stem **210**. The upper operating stem **210** is coupled to a lower operating stem **220** by a safety coupling **218** and coupling pins and keys **214**, **216**. The lower operating stem **220** passes through a valve seat ring **222**.

A tri-arm valve top plate **230** is mounted on the lower operating stem **220**. The valve seat rubber **234** and the valve bottom plate **236** also are mounted on the lower operating stem **220**. A bottom plate nut **240** and seal **238** secure the valve seat rubber **234** to the valve bottom plate **236** on the lower operating stem **220**. The valve seat rubber **234** can be formed from any suitable material (e.g., rubber, plastic, nylon, acetal resin materials (e.g., Delrin), Teflon, polyethylene terephthalate (PET), ultra high molecular weight (UHMW) polyethylene, or other suitable materials and combinations thereof). The tri-arm valve top plate **230**, the valve seat ring **222**, and the valve bottom plate **236** are described in more detail below with reference to FIGS. **4**A-**4**C, **5**A-**5**F and **6**A-**6**C. The operation of the valve control device **200** is described in more detail below with reference to FIGS. **9**A-**9**D.

FIGS. **3**A-**3**G show different views of the inlet elbow **300**, in accordance with one embodiment of the invention. FIG. **3**A is a perspective view of the inlet elbow **300**, in accordance with one embodiment of the invention. FIG. **3**B is a side view of the inlet elbow **300**, in accordance with one embodiment of the invention. FIG. **3**C is a front view of the inlet elbow **300**, in accordance with one embodiment of the invention. FIG. **3**D is a sectional view **3**D-**3**D (see FIG. **3**C) of the inlet elbow **300**, in accordance with one embodiment of the invention. FIG. **3**E is a top view of the inlet elbow **300**, in accordance with one embodiment of the invention. FIG. **3**F is a sectional view **3**F-**3**F (see FIG. **3**D) of the inlet elbow **300**, in accordance with one embodiment of the invention. FIG. **3**G is a bottom view of the inlet elbow **300**, in accordance with one embodiment of the invention.

Referring now to FIG. **3**A, the inlet elbow **300** includes a supply flange **302**, an elbow body **304** and an outlet flange **306**. The outlet flange **306** includes a drain ring recess **308** and a saturation ring seat **310**. The drain ring **198** fits into the drain ring recess **308** and the saturation ring **199** fits over the drain ring and rests on the saturation ring seat **310**. The operation of the drain ring **198**, drain ring recess **308**, saturation ring **199** and saturation ring seat **310** are described in more detail below with reference to FIGS. **9**A-**9**D and **10**A.

As shown in FIGS. **3**D and **3**E, the elbow body **304** has a contoured floor **320**. The contoured floor **320** is raised and/or curved to improve the flow characteristics of the water flowing through the elbow body **304** and though the valve control device **200**. The contoured floor **320** curves upward from the bottom inner surface **304**A of the elbow body **304** to a plateau **304**B that is below the valve control device **200** (FIG. **3**D).

A protrusion **304**C receives the bottom plate nut **240** and allows the valve control device **200** to descend downward into the elbow body **304** until the bottom plate **236** contacts the plateau **304**B and/or the bottom plate nut contacts the protrusion. The plateau **304**B spans an angle θ between about 270 degrees and about 120 degrees (see FIG. **3**F). The floor **320** can be straight or curved between the bottom inner surface **304**A to the plateau **304**B. The floor **320** can be a combination of curved and/or flat surfaces between the bottom inner surface **304**A to the plateau **304**B.

FIGS. **4**A-**4**E show different views of the tri-arm valve top plate **230**, in accordance with one embodiment of the invention. FIG. **4**A is a perspective view of the tri-arm valve top plate **230**, in accordance with one embodiment of the invention. FIG. **4**B is a top view of the tri-arm valve top plate **230**, in accordance with one embodiment of the invention. FIG. **4**C is a bottom view of the tri-arm valve top plate **230**, in accordance with one embodiment of the invention. FIG. **4**D is a side view of the tri-arm valve top plate **230**, in accordance with one embodiment of the invention. FIG. **4**E is a sectional view **4**E-**4**E (see FIG. **4**D) of the tri-arm valve top plate **230**, in accordance with one embodiment of the invention. The tri-arm valve top plate **230** has a substantially conical base **402** having an angle α of between about 20 degrees and about 60 degrees between the surface of the conical base and the substantially flat bottom surface **404** of the tri-arm valve top plate **230** (see FIG. **4**E).

The tri-arm valve top plate **230** includes three substantially equally spaced stabilizer arms **406**. The three stabilizer arms **406** can be spaced at angle β of between about 90 degrees and about 135 degrees between the respective centerlines of the stabilizer arms (see FIG. **4**B). It should be understood that while the tri-arm valve top plate **230** is shown and described with three stabilizer arms, more than three (e.g., four or five or more) stabilizer arms could be included.

The stabilizer arms **406** have a substantially flat outer surface **408**. The outer surfaces **408** fit into slots **502** of the valve seat ring **222** as will be described in more detail below. Replaceable inserts **228** can be installed on the outer surfaces **408** of the stabilizer arms **406** (see FIG. **4**E). The replaceable inserts **228** can be secured to the outer surfaces **408** with fasteners **226**. The outer surfaces **408** can include recesses **408**A that substantially surround the replaceable inserts **228** on one or more sides of the replaceable inserts.

The stabilizer arms **406** have a substantially triangular cross section shape having an inner angle Ω that is opposite to the outer surfaces **408** (see FIG. **4**B). The inner angle Ω is between about 20 degrees and about 45 degrees.

The stabilizer arms **406** have an angled and/or tapered inner surface **410**. The inner edge **410** extends from the conical base **402** to the ends **406**A of each of the stabilizer arms. The inner edge **410** can have a curve of one or more radii and/or straight portions. The tri-arm valve top plate **230** includes a valve top central channel **412** in the center of the tri-arm valve top plate. The tri-arm valve top plate **230** also includes a stem pin groove **414**. A stem pin **232** passes through the stem pin groove **414** and a stem bore in the lower operating stem **220** (see FIG. **2**).

FIGS. **5**A-**5**G show different views of the valve seat ring **222**, in accordance with one embodiment of the invention. FIG. **5**A is a perspective view of the valve seat ring **222**, in accordance with one embodiment of the invention. FIG. **5**B is a top view of the valve seat ring **222**, in accordance with one embodiment of the invention. FIG. **5**C is a side view of the valve seat ring **222**, in accordance with one embodiment of the invention. FIGS. **5**D and **5**G are sectional views **5**D-**5**D (see FIG. **5**C) view of the valve seat ring **222**, in accordance with one embodiment of the invention. FIG. **5**E is a detail view of the slots **502** in the valve seat ring **222**, in accordance with one embodiment of the invention. FIG. **5**F is a detail view of the drain holes **504** in the valve seat ring **222**, in accordance with one embodiment of the invention.

The slot **502** has a depth tolerance of about 0.003" from a center **552** of the valve seat ring **222**. A bottom portion **506** of the valve seat ring **222** seats into the inlet elbow **300**. By way of example, the valve seat ring **222** can seat into the inner diameter **308**A of the drain ring recess **308** in the outlet flange **306** of the inlet elbow **300** (see FIG. **3**A).

The valve seat ring **222** can include a threaded portion **508**. The threaded portion **508** can thread into the drain ring **198** (see FIG. **1**). At least one of the slots **502** includes at least one drain hole **504**. The drain hole **504** can have any suitable shape e.g., round, rectangular, oval or elliptical. The valve seat ring **222** includes a valve seat **510** on the inner surface of the bottom portion **506**. The valve seat **510** has an angle λ of between about 30 and about 89 degrees (see FIG. **5**D). As will be explained in more detail below, the angle λ of the valve seat **510** is selected to receive the seat valve rubber **234** and close the valve control device **200** to stop water flow through the inlet elbow **300** and into the standpipe **195**.

Referring to FIG. **5**G, the drain hole **504** can be round or other shape. It should be understood that while the drain holes **504** are shown in a substantially round or oval shape the drain port shape can be round, square or other shape. The drain holes **504** are in the slots **502** at the correct height such that the tri-arm valve top plate **230** can cover and uncover the holes at the correct times in the opening and closing of the valve as described in more detail below.

As shown in FIG. **5**G, the drain holes **504** are included in a slightly raised plateau **504**A. The slightly raised plateau **504**A is raised about 0.010 inch +/− about 0.001 inch from the slot **502**. The raised plateau **504**A can aid in sealing the drain holes **504** when the drain holes are covered by the tri-arm valve top plate **230**. The raised plateau **504**A provides a surface area to form a seal with the replaceable inserts **228** installed on the outer surfaces **408** of the stabilizer arms **406** of the tri-arm valve top plate **230**. The surface area of the raised plateau **504**A is less than the surface area of the slot **502**. The surface area of the raised plateau **504**A can be less than about one third of the surface area of the slot **502**. By way of example, the surface area of the raised plateau **504**A can be less than about one fifth of the surface area of the slot **502**.

The smaller surface area of the raised plateau **504**A improves the sealing function of the tri-arm valve top plate **230**. The smaller surface area of the raised plateau **504**A also reduces the friction between the tri-arm valve top plate **230** and the slot **502**, thus providing a smoother, longer lasting, more reliable operation of the valve control device **200**.

FIGS. **6**A-**6**C show different views of the valve bottom plate **236**, in accordance with one embodiment of the invention. FIG. **6**A is a top view of the valve bottom plate **236**, in accordance with one embodiment of the invention. FIG. **6**B is a sectional view **6**B-**6**B (see FIG. **6**A) of the valve bottom plate **236**, in accordance with one embodiment of the invention. FIG. **6**C is a side view of the valve bottom plate **236**, in accordance with one embodiment of the invention. As shown in FIG. **6**B, the valve bottom plate **236** has recess **602**. The recess **602** has a valve seat **604**. The valve seat **604** has an angle λ' of between about 30 and about 89 degrees. The recess **602** receives the seat valve rubber **234**. The seat valve rubber **234** is secured between the valve bottom plate **236** and the bottom surface **404** of the tri-arm valve top plate **230**.

The valve bottom plate **236** also includes a valve bottom plate central channel **606**. The lower operating stem **220** (see FIG. **2**) passes through the valve top central channel **412** of the tri-arm valve top plate **230** and the valve seat rubber **234** and through the valve bottom plate central channel **606**. The valve bottom plate **236**, the valve seat rubber **234** and the tri-arm valve top plate **230** are secured to the lower operating stem **220** between the stem pin groove **414** (see FIG. **4**A) and the bottom plate nut **240**.

Standpipe Drain System

FIGS. **7**A-**7**C show different views of the saturation ring **199**, in accordance with one embodiment of the invention. FIG. **7**A is a top view of the saturation ring **199**, in accordance with one embodiment of the invention. FIG. **7**B is a side view of the saturation ring **199**, in accordance with one embodiment of the invention. FIG. **7**C is a sectional view **7**C-**7**C (see FIG. **7**A) of the saturation ring **199**, in accordance with one embodiment of the invention. The saturation ring **199** includes two or more bolt holes **702**. The bolt holes are aligned with the bolts **196** that couple the standpipe **195** to the inlet elbow **300** (see FIG. **1**). The saturation ring **199** includes a substantially flat top seat **708**. The top seat **708** includes a seal groove **708**A. The underside of the saturation ring **199** includes a drain channel **710** and multiple notches **704** and outlet notches **706**.

FIGS. **8**A-**8**C show different views of the drain ring **198**, in accordance with one embodiment of the invention. FIG. **8**A is a top view of the drain ring **198**, in accordance with one embodiment of the invention. FIG. **8**B is a sectional view **8**B-**8**B (see FIG. **8**A) of the drain ring **198**, in accordance with one embodiment of the invention. FIG. **8**C is a side view of the drain ring **198**, in accordance with one embodiment of the invention. As shown in FIG. **8**B, the drain ring **198** includes a threaded portion **802**. The threaded portion **802** meshes with the threaded portion **508** of the valve seat ring **222**.

The drain ring **198** also includes multiple drain nipples **804**. Each of the drain nipples **804** includes a drain port **806**. The drain nipples **804** substantially aligned with the notches **704** in the saturation ring **199**. Each of the drain ports **806** can be aligned with one of the drain holes **504** in the valve seat ring **222** (see FIG. **5**A).

FIGS. **9**A-**9**F show different views of the inlet elbow **300** and the valve control device **200**, in accordance with one embodiment of the invention. FIG. **9**A is an inlet view of the inlet elbow **300** and the valve control device **200**, in accordance with one embodiment of the invention. FIG. **9**B is a sectional view **9**B-**9**B (see FIG. **9**A) of the inlet elbow **300** and the valve control device **200** in a closed position, in accordance with one embodiment of the invention. FIG. **9**C is a detailed view of the inlet elbow **300** and the valve control device **200** in the closed position, in accordance with one embodiment of the invention. FIG. **9**D is a sectional view **9**B-**9**B (see FIG. **9**A) of the inlet elbow **300** and the valve control device **200** in a partially opened position, in accordance with one embodiment of the invention. FIG. **9**E is a sectional view **9**B-**9**B of the inlet elbow **300** and the valve control device **200** in a fully open position, in accordance with one embodiment of the invention. FIG. **9**F is a sectional view **9**B-**9**B (see FIG. **9**A) of the inlet elbow **300** and the valve control device **200** in a slightly open position **950**, in accordance with one embodiment of the invention.

A circuitous drain route **902** is formed between the inside of the standpipe **195** (e.g, an outlet portion **530** of the valve seat ring **222**) and the outside of the standpipe. The circuitous drain route **902** is defined by the drain holes **504** in the valve seat ring **222**, the drain ports **806** in the drain ring **198** and the notches **704**, outlet notches **706** and drain channel **710** in the saturation ring **199**. The circuitous drain route **902** allows the standpipe **195** to drain when the valve control device **200** is in the closed position **900**. The circuitous drain route **902** prevents intrusion and blockage by dirt and plant roots (e.g., trees, bushes and other plant root systems). The circuitous drain route **902** is closed or cut off by the outer surfaces **408** of the stabilizer arms **406** of the tri-arm valve top plate **230**. By way of example, when the valve control device **200** is in the partially open position **910** (FIG. **9**D) as compared to the fully open position **920** (FIG. **9**E). The circuitous drain route **902** appears to be shown as being a direct through path, however, it should be understood that the drain holes **504**, the outlet notches **706** and the drain ports **806** are offset radially around the circumference. The water draining through the circuitous drain route **902** turns left or right radially from each of the drain holes **504** to pass through one or more drain ports **806** and again turns left or right radially from each of the drain ports to one or more of the outlet notches **706**.

The valve control device **200** also includes a pressure drain position **950** as shown in FIG. **9**F. As the valve control device **200** moves to a slightly open position to form a very small gap **912"** is formed between the seat valve rubber **234** and the valve seat **510** in the valve seat ring **222**. Simultaneously, the tri-arm valve top plate **230** slightly uncovers the drain holes **504** in the valve seat ring **222**. As water pressure still exists inside the valve control device **200**, the water pressurizes the circuitous drain route **902**. By way of example, the water pressure causes the water to rush out the drain holes **504** and the drain ports **806** in the drain ring **198** and the notches **704**, outlet notches **706** and drain channel **710** in the saturation ring **199**, thus flushing out the drain route **902**. Flushing out the drain route **902** substantially removes any debris that might have accumulated in the drain route. The debris might originate from the water flowing through the valve control device **200** or from the valve control device **200**, fire hydrant body **100**, standpipe **195** and/or the inlet elbow **300**. The debris might also or alternatively originate from sources external of the fire hydrant body **100**, standpipe **195** and/or the inlet elbow **300** such as sand, gravel, dirt, insects, worms and/or plant/tree roots.

FIG. **10** is a flow chart diagram **1000** illustrating the method operations performed in operating the valve control device **200**, in accordance with one embodiment of the invention. In an operation **1005**, the operating nut **202** is partially rotated in a first direction **930** as shown in FIG. **9**D. Partially rotating the operating nut **202** applies a downward pressure on the upper operating stem **210**, lower operating stem **220** and the valve top plate **230** causing the valve top plate to move downward. Moving the valve top plate **230** downward moves the valve top plate into the partially open position **910**. In the partially open position **910**, a relatively small gap **912** is formed between the seat valve rubber **234** and the valve seat **510** in the valve seat ring **222**. The relatively small gap **912** allows a partial water flow **906** through the inlet elbow **300** and past the seat valve rubber **234** into the standpipe **195**. The three (or more) stabilizer arms **406** and the conical base **402** of the valve top plate **230** improves flow and stability under partial water flow conditions that can jam a typical valve control device.

In an operation **1010**, the operating nut **202** is fully rotated in the first direction **930'** to a stopping position as shown in FIG. **9**E. Fully rotating the operating nut **202** in the first direction **930'** fully depresses the upper operating stem **210**, lower operating stem **220** and the valve top plate **230** in direction **942**A. Fully depressing the valve top plate **230** moves the valve top plate into the fully open position **920**. In the fully open position **920**, a maximum open gap **912'** is formed between the seat valve rubber **234** and the valve seat **510** in the valve seat ring **222**. The maximum open gap **912'** allows a maximum water flow **908** through the inlet elbow **300** and past the seat valve rubber **234** into the standpipe **195**.

The contoured floor **320** of the elbow body **304** reduces the turbulence and otherwise smoothes the water flow **908** through the maximum open gap **912'**. The substantially triangular cross section shape of the three (or more) stabilizer arms **406** and the conical base **402** of the valve top plate **230** also reduces the turbulence in and otherwise smoothes the water flow **908**. The reduced turbulence and smoothed water flow **908** allows a greater quantity of water to pass through the maximum open gap **912'** with a reduced pressure drop through the valve control device **200**.

In an operation **1015**, the operating nut **202** is partially rotated in a second direction **940** opposite the first direction **930** approaching a fully closed position but remaining partially open as shown in FIG. **9**F. Rotating the operating nut **202** in the second direction **940** draws the upper operating stem **210**, lower operating stem **220** and the valve top plate **230** partially upward in direction **942**B. Drawing the valve top plate **230** partially upward moves the valve top plate into the pressure drain position **950**. In the pressure drain position **950**, a relatively small gap **912"** remains between the seat valve rubber **234** and the valve seat **510** in the valve seat ring **222**. The valve top plate **230** opens at least one drain hole **504** in the valve seat ring **222**, thus opening the circuitous drain route **902**. As the water in the standpipe **195** and the valve control device **200** is still pressurized, then the water will flow under that pressure through the circuitous drain route **902** and flush the circuitous drain route.

In an operation **1020**, the operating nut **202** is fully rotated in a second direction **940** opposite the first direction **930** to a stopping position as shown in FIG. **9**B. Fully rotating the operating nut **202** in the second direction **940** draws the upper operating stem **210**, lower operating stem **220** and the valve top plate **230** fully upward in direction **942**B. Drawing the valve top plate **230** fully upward moves the valve top plate into the fully closed position **920**. In the fully closed position **920**, the seat valve rubber **234** seals against the valve seat **510** in the valve seat ring **222**, thus cutting off all water flow **906**, **908** through the inlet elbow **300** and past the seat valve rubber **234** into the standpipe **195**. As the valve top plate **230** moves from the fully open position **930**, through the partially open position **910** toward the fully closed position **920**, the three (or more) stabilizer arms **406** and the conical base **402** of the valve top plate **230** improves flow and stability under partial water flow conditions that can jam a typical valve control device.

In an operation **1025**, closing the valve control device **200** uncovers at least one drain hole **504** in a slot of a saturation ring **222**. The drain hole **504** is in an outlet portion of the valve seat ring **222**. In an operation **1030**, the circuitous drain route **902** is opened when the valve top plate is in the fully closed position **920**.

In an operation **1035**, the water contained in the standpipe **195** drains through the circuitous drain route **902** to an external portion standpipe **195**. The circuitous drain route **902** includes the at least one drain hole **504** in the valve seat ring **222**, a one or more drain ports **806** in the drain ring **198** and at least one of the notches **704** and at least one of the outlet notches **706** and the drain channel **710** in the saturation ring **199**.

Valve Access Channel Drain System

FIGS. **11A-11C** show different views of the fire hydrant body **100**, in accordance with one embodiment of the invention. FIG. **11**A is a front view of the fire hydrant body **100**, in accordance with one embodiment of the invention. FIG. **11**B is a sectional view **11**B-**11**B (see FIG. **11**A) of the fire hydrant body **100**, in accordance with one embodiment of the invention. FIG. **11**C is a top view of the fire hydrant body **100**, in accordance with one embodiment of the invention. The fire hydrant body **100** includes a valve access channel drain port **1102**. The valve access channel drain port drains any water from the valve access channel **100**C-**3**. Draining the water from the valve access channel **100**C-**3** helps prevent corrosion and freezing that may interfere with proper operation of the locking cap **106** and/or the valve control device **200**.

FIGS. **12A-12C** show different views of the fire hydrant body **100**, in accordance with one embodiment of the invention. FIG. **12**A is a front view of the fire hydrant body **100**, in accordance with one embodiment of the invention. FIG. **12**B is a sectional view **12**B-**12**B (see FIG. **12**A) of the fire hydrant body **100**, in accordance with one embodiment of the invention. FIG. **12**C is a top view of the fire hydrant body **100**, in accordance with one embodiment of the invention. The fire hydrant body **100** includes one or more valve access channel drain **1202**. The valve access channel drain channel **1202** drains any water from the valve access channel **100**C-**3**.

The valve access channel drain channel **1202** slopes slightly downward toward the cap body **106**C of locking cap **106**. The slope **1204** can be very slight such as about 2 degrees down from a horizontal **1206**. If needed the degree of slope **1204** can be increased to achieve the desired drainage. The valve access channel drain channel **1202** can be straight or have a slight downward curvature.

In summary, the present invention provides a valve control device for fire hydrant that includes, among other features, an improved flow system through the valve control device and an improved standpipe drain system. The invention has been described herein in terms of several exemplary embodiments. Other embodiments of the invention will be apparent to those skilled in the art from consideration of the specification and practice of the invention. The embodiments and preferred features described above should be considered exemplary, with the invention being defined by the appended claims and equivalents thereof.

What is claimed is:

1. A method of draining a standpipe comprising:

moving a valve control device toward a closed position sufficient to uncover at least one drain hole before the valve control device achieves a fully closed position, the at least one drain hole being disposed in a slot of a valve seat ring; and

draining a contents of the standpipe through a drain route to an external portion of the standpipe, the drain route is defined by the at least one drain hole in the valve seat ring, a plurality of drain ports in a drain ring, a plurality of outlet notches and a drain channel in a saturation ring, the drain route providing a fluid communication route between an outlet portion of the valve seat ring in the standpipe and an external portion of the standpipe, wherein each of the at least one drain hole in the valve seat is radially offset from each of the plurality of drain ports in the drain ring and wherein each of the plurality of drain ports are radially offset from each of the plurality of outlet notches in the saturation ring.

2. The method of draining a standpipe of claim **1**, further comprising opening the valve control device including covering the at least one drain hole in the slot of the saturation ring.

3. The method of draining a standpipe of claim **1**, wherein the at least one drain hole in the slot of the valve seat ring is covered by an outer surface of a stabilizer arm of a valve top plate.

4. The method of claim **3**, wherein closing the valve control device includes raising the valve top plate on an operating stem.

5. The method of claim **4**, wherein the operating stem is coupled to an operating nut and raising the valve top plate includes rotating the operating nut.

6. The method of claim **5**, wherein the operating nut is disposed in a fire hydrant.

7. The method of draining a standpipe of claim **1**, wherein the at least one drain hole in the slot of the valve seat ring is uncovered by moving an outer surface of a stabilizer arm of a valve top plate in the slot in the valve seat ring until the at least one drain hole is uncovered.

8. The method of draining a standpipe of claim **7**, wherein the valve top plate includes a conical base with at least three stabilizer arms extending therefrom, each of the at least three stabilizer arms having a flat outer surface wherein each of the at least three stabilizer arms has an inner edge opposite the outer surface, the inner edge having a concave curve having one or more radii, the at least three stabilizer arms are disposed around the conical base so that centerlines of the stabilizer arms are spaced apart by between a range of 90 and 135 degrees.

9. The method of claim **8**, wherein the conical base forms an angle of between 20 degrees and 60 degrees between the surface of the conical base and the flat bottom surface of the valve top plate.

10. The method of draining a standpipe of claim **1**, wherein the standpipe is coupled to a fire hydrant.

11. The method of draining a standpipe of claim **10**, wherein the fire hydrant is a locking fire hydrant including a locking cap mounted on the fire hydrant, the locking cap being configured to close off a main outlet port and an access to the operating nut.

12. The method of draining a standpipe of claim **1**, wherein closing the valve control device includes uncovering the at least one drain hole in the slot of a valve seat ring before the valve control device fully closes to perform a pressure drain operation to flush the drain route.

13. A method of flushing a standpipe drain route comprising:

opening a valve control device a first amount sufficient to allow water to flow into the standpipe under pressure from a water supply pipe, wherein the first amount uncovers at least one drain hole in a slot of a valve seat ring, the at least one drain hole being in an outlet portion of the valve seat ring;

flushing pressurized water through the drain route, the drain route is defined by the at least one drain hole in the valve seat ring, a plurality of drain ports in a drain ring, a plurality of outlet notches and a drain channel in a saturation ring, the drain route providing a fluid communication route between an outlet portion of the valve seat ring in the standpipe and an external portion of the standpipe, wherein each of the at least one drain hole in the valve seat is radially offset from each of the plurality of drain ports in the drain ring and wherein each of the plurality of drain ports are radially offset from each of the plurality of outlet notches in the saturation ring.

14. A valve control device comprising:

a valve top plate having a conical base with at least three stabilizer arms extending therefrom, each of the at least three stabilizer arms having a flat outer surface wherein each of the at least three stabilizer arms has an inner edge opposite the outer surface, the inner edge having a concave curve having one or more radii wherein the at least three stabilizer arms are disposed around the conical base so that centerlines of the stabilizer arms are spaced apart by between a range of 90 and 135 degrees;

a valve seat rubber;

a valve bottom plate securing the valve seat rubber between the valve bottom plate and a flat bottom surface of the valve top plate, the valve bottom plate, the valve seat rubber and the conical base being mounted on the operating stem; and

a valve seat ring having a plurality of slots, each of the plurality of slots corresponding to one of the at least three stabilizer arms.

15. The valve control device of claim **14**, further comprising an operating stem coupled to the valve top plate, wherein the operating stem includes an operating nut.

16. The valve control device of claim **15**, wherein the operating nut is disposed in a fire hydrant.

17. The valve control device of claim **16**, wherein the operating nut is separated from the fire hydrant by an operating nut sleeve.

18. The valve control device of claim **17**, wherein the operating nut sleeve is formed from at least one of an acetal resin (Delrin®) material and a polyethylene terephthalate (PET) material and a ultra high molecular weight (UHMW) polyethylene material.

19. The valve control device of claim **14**, wherein each of the at least three stabilizer arms include a replaceable insert disposed between an outer surface of each of the at least three stabilizer arms and a corresponding one of the plurality of slots in the valve seat ring, the replaceable insert is formed from at least one of an acetal resin (Delrin®) material and a polyethylene terephthalate (PET) material and a ultra high molecular weight (UHMW) polyethylene material.

20. The valve control device of claim **14**, further comprising a drain route to an external portion of a standpipe, the drain route is defined by at least one drain hole disposed in a slot in the valve seat ring, a plurality of drain ports in a drain ring, a plurality of outlet notches and a drain channel in a saturation ring, the drain route providing a fluid communication route between an outlet portion of the valve seat ring in the standpipe and an external portion of the standpipe, wherein each of the at least one drain hole in the valve seat is radially offset from each of the plurality of drain ports in the drain ring and wherein each of the plurality of drain ports are radially offset from each of the plurality of outlet notches in the saturation ring.

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